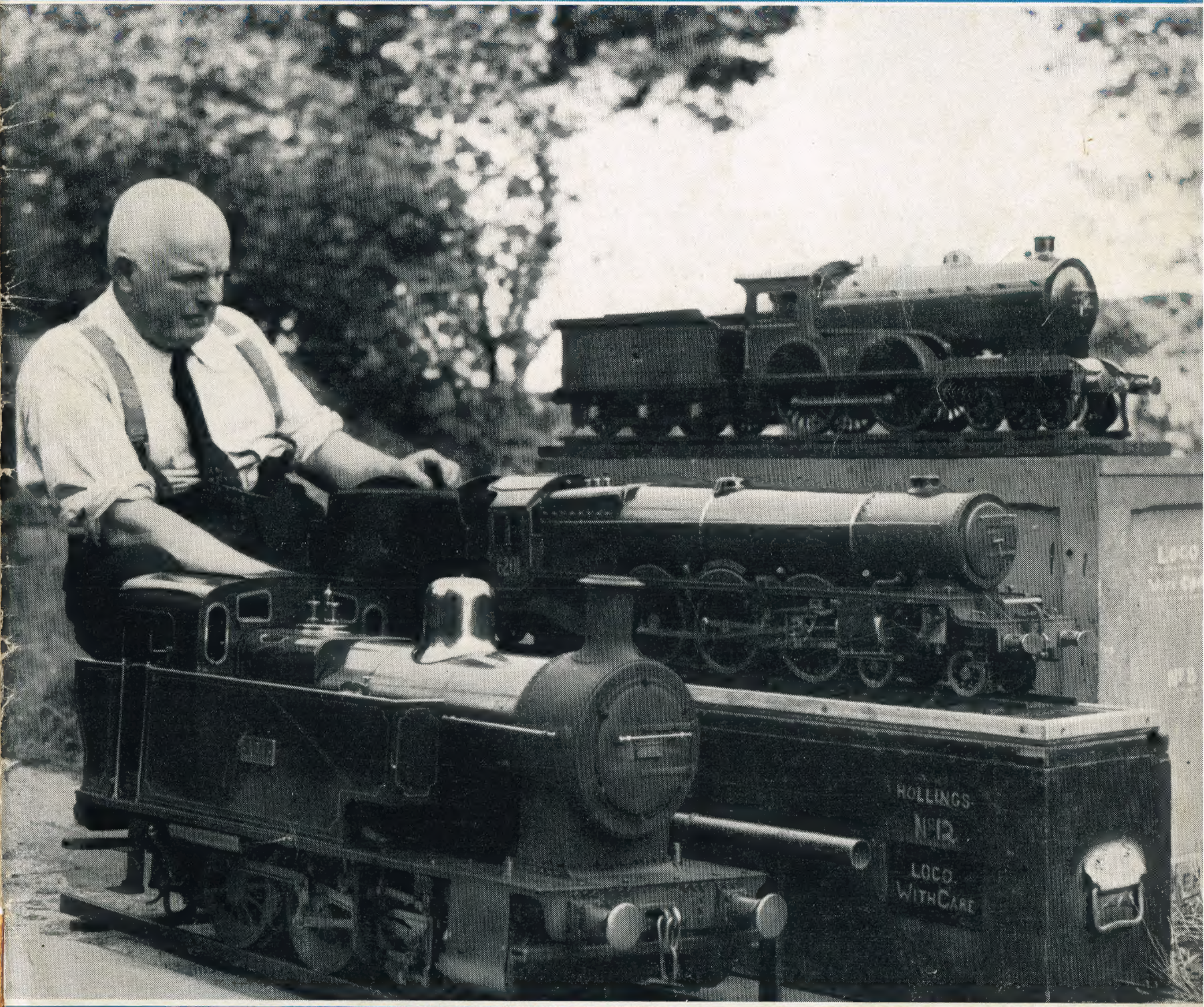
THE
MODEL ENGINEER



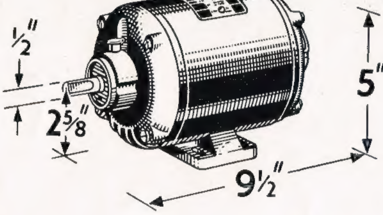
IN THIS ISSUE

FEBRUARY 4th 1954
Vol. 110 No. 2750

9D

Motors for your Workshop or Model

BROOK "BS.42" FRACTIONAL

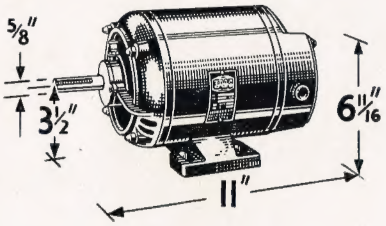


A strongly built motor, small in dimensions but giving useful power.

⅛ h.p. Single Phase 1,440 r.p.m.

PRICE . . . £6 . 5 . 0

BROOK "GRYPHON" FRACTIONAL

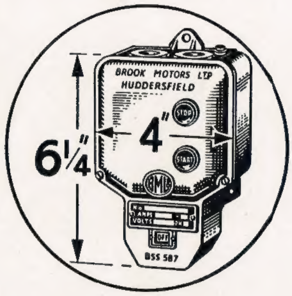


A firm favourite with the model engineer.

¼ h.p. Single Phase 1,440 r.p.m.

PRICE . . . £7 . 1 . 0

AT3 DIRECT - ON - LINE STARTER



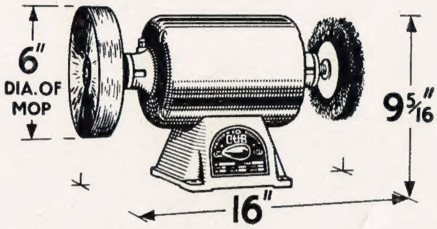
12 amps. max.

PRICE . . . £2 . 3 . 0

BUFFING AND POLISHING MOTOR

¼ h.p. Single Phase 1,440 r.p.m.

PRICE . . . £18 . 17 . 0



From your tool factor or electrical contractor

BROOK MOTORS LIMITED

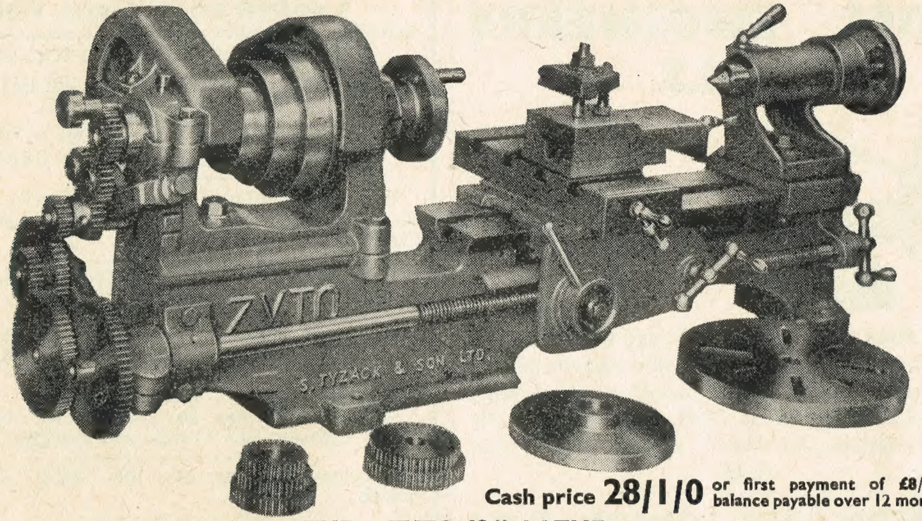
HUDDERSFIELD

I.NA.300

THE "ZYTO" B.G.S.C. LATHES

BRITAIN'S FINEST LATHE VALUE

★ ACCURATE & DEPENDABLE ★ NOW MADE 12½" & 16" BETWEEN CENTRES ★

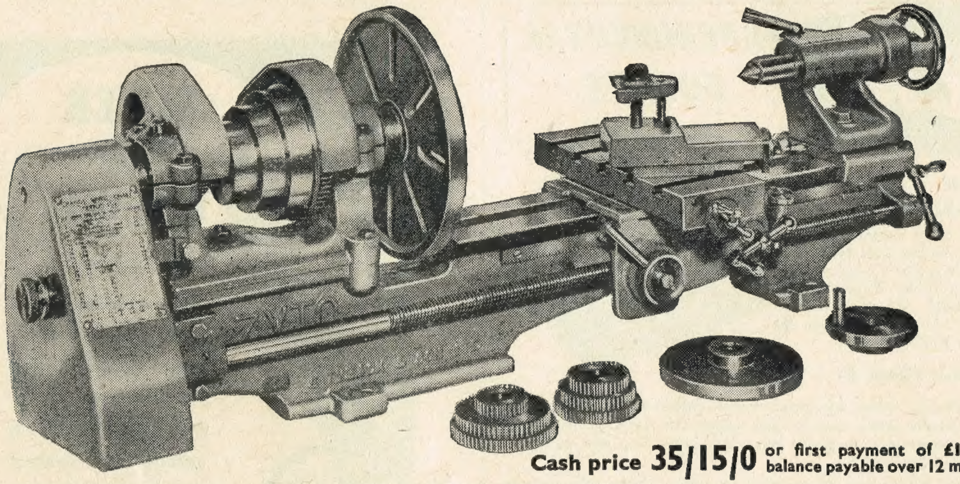


Cash price 28/1/0 or first payment of £8/17/6 balance payable over 12 months.

THE "ZYTO 12" LATHE

Height of centres	3⅜ in.	Tailstock Barrel Admit	⅜ in.
Distance between centres	12½ in.	Headstock Pulley, 3-speed	¾ in. flatbelt
Height from gap	4½ in.	Faceplate, dia.	6 in.
Height from Saddle	2 in.	Overall length of Lathe	30 in.
Guide Screw	8 T.P.I.	Change Wheels : 20, 25, 30, 35, 40, 45, 50, 55, 60, 65	
Headstock Mandrel Admit	⅜ in.		

Back Geared Guards and Change Wheels, together with Catch Plate and Finished Back Plate for Chuck are all included.



Cash price 35/15/0 or first payment of £10/19/0 balance payable over 12 months.

THE "ZYTO 16" LATHE

Height of centres	3⅜ in.	Tailstock Barrel Admit	⅜ in.
Distance between centres	16 in.	Headstock Pulley, 3-speed	¾ in. flatbelt
Height from gap	4½ in.	Faceplate, dia.	8 in.
Height from Saddle	2 in.	Overall length of Lathe	34 in.
Guide Screw	8 T.P.I.	Change Wheels : 20, 25, 30, 35, 40, 45, 50, 55, 60, 65	
Headstock Mandrel Admit	⅜ in.		

Complete Gear Guard. Extra long Compound Sliderest. Gear Chart included.

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THE MODEL ENGINEER

EVERY THURSDAY

Volume 110 - No. 2750

FEBRUARY 4th - 1954

ESTABLISHED 1898

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CONTENTS

Our Cover Picture

One of the really stalwart supporters of the "live steam" fraternity in the North of England is W. D. Hollings ("Dan" to his friends), until lately the hon. secretary of the West Riding Small Locomotive Society, of Bradford. Our cover picture shows him surveying the results of ten years' work—three fine locomotives. At the top is a $3\frac{1}{2}$-in. gauge 4-4-0 built after "L.B.S.C.'s" design for *Miss-ten-to-Eight* and finished in 1940. In the middle is a $3\frac{1}{2}$-in. gauge ex-L.M.S. "Princess Royal" class Pacific which won a diploma at THE MODEL ENGINEER Exhibition in 1947. At the bottom is a fine $1\frac{1}{2}$-in. scale 0-6-0 tank engine, based on the ex-L.M.S. Class "2F" dock shunter, which won a bronze medal at THE MODEL ENGINEER Exhibition in 1948. All these engines have seen much service and have proved most successful. Bravo, Dan!

SMOKE RINGS

British Railways Programme, 1954

THE PROGRAMME for the construction of new locomotives and rolling-stock in 1954 gives some rather astonishing figures; it includes the provision of 2,750 passenger train vehicles, 53 freight wagons and 325 locomotives.

All the passenger vehicles and brake vans will be of the new standard all-steel design; 1,820 will be passenger carrying vehicles and the remaining 930 will be brake-vans, horse boxes, fish vans, and other vans for running in passenger trains.

New wagons will include 3,100 for carrying loads of steel weighing up to 50 tons, and various wagons of special design for carrying loads of 21 to 65 tons. Of the total of 53,000 new wagons, 20,000 will be built in British Railways shops and the remainder by contractors.

Of the 325 locomotives to be built, 254 will be of the new standard design including 40 "Class 9" heavy freight engines, the first of this type to be built and the most powerful in the B.R. standard range. There will also be 14 diesel-mechanical shunters, and 50 steam tank engines for shunting.

The Wrong Idea

IN ONE or two letters that have been received recently at these offices, the writers have, among other things, complained of the repeated appearance, year after year, of "the same old locomotives" at exhibitions and fetes whenever a passenger-carrying track has been borrowed from a model engineering society; and they ask if it "isn't about time that some new engines were built and run." An earlier letter of this kind was printed in our issue of October 1st last and replied to by Mr. H. E. White on November 12th; but it seems that there are some readers who did not see either of these letters.

However, we began to ponder over these complaints, only to find that they raise other questions in the editorial mind. Is there anything wrong with the repeated appearance of locomotives at exhibitions, fetes and the like? We think not; they have become old friends, and we are always pleased to see them because of that. And the fact that these old friends can be brought out, year after year, to cope with the job of hauling passengers, time after time, is a matter for high praise for the enthusiastic builders, owners and maintainers of the locomotives; it is a source of inspiration to others to go and do the same.

But, thinking a little deeper, we find ourselves wondering if it is really true to suggest, or imply, that no new engines are being built or run. Turning over the pages of recent volumes of the "M.E." we find plenty of evidence to suggest the exact opposite; at least once a month, on the average, we have illustrated, and usually described, a new engine recently finished by a reader who reports that it is a successful passenger hauler.

No! We feel that the complaints we have referred to are founded on the wrong idea; there are plenty of new engines to be seen, though they may not all be present on any one particular occasion. But we hope that we shall have, for many years yet, plenty of opportunities of welcoming the old friends as well.

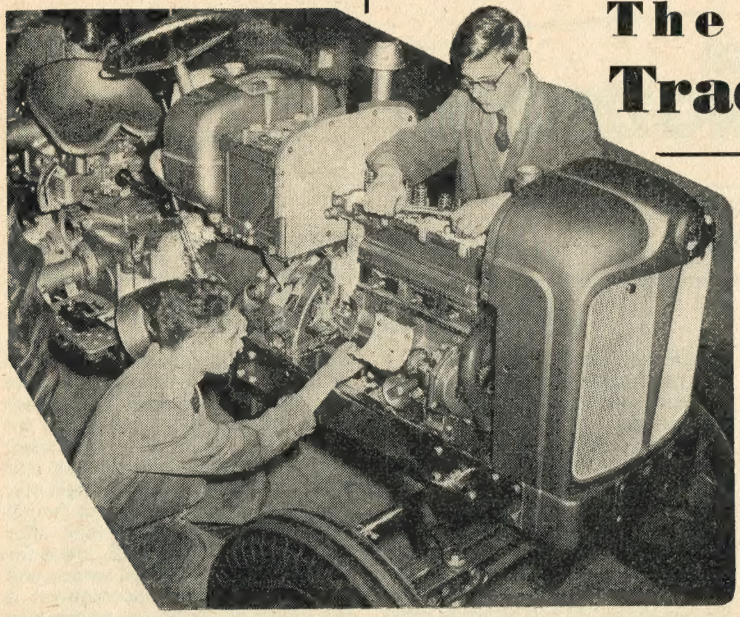
Bulawayo S.M.E.

WE WERE pleased to hear recently from Mr. B. H. Nathan, hon. secretary of the Bulawayo Society of Model Engineers, who states that after something of a struggle since it was founded last March, the club now seems to be firmly established.

It cannot be easy to run such a club in East Africa, since the members have to contend with difficulties that are unknown to us in Britain, and we imagine that enthusiasm and determination are more than usually necessary to bring almost any work to a satisfactory conclusion. Mr. Nathan's address, by the way, is 4881 Sauers town, Bulawayo, Southern Rhodesia.

The Ford Trade School

By C. Attwood
(Principal)



Boys of the Ford Trade School put the finishing touches to a cut-away model of their Fordson Major Diesel, which was exhibited at the 1953 *Smithfield Show*

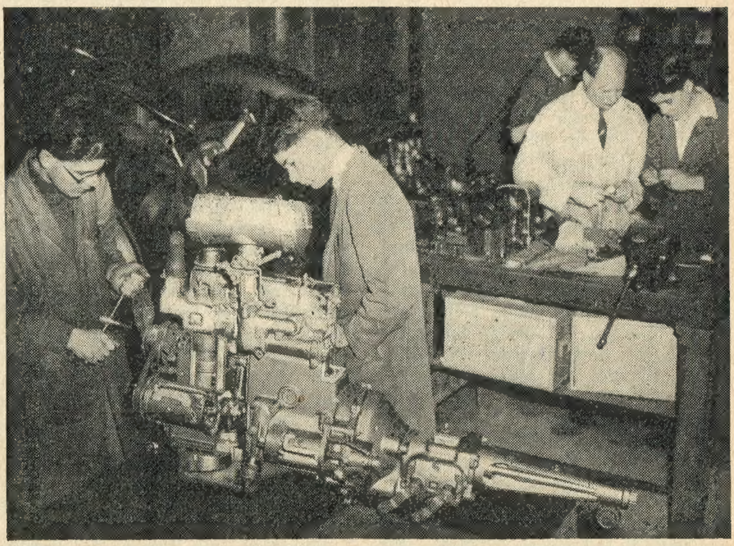
THE now widely accepted view that industry should provide adequate opportunities for the broad educational development of its young members in addition to vocational training, was recognised at an early stage by the Ford Motor Company. The first trade school was founded at Detroit in 1916 and, from the beginning, two principles were established that have been followed by all schools in Ford organisations throughout the world. These are that an essential part of a student's education is learning how to do useful jobs and how to make useful things, and that every student should be paid a regular wage, enabling him to make a substantial contribution towards his own support, so that monetary considerations need not be a handicap to a boy joining the school.

The trade school of the British company was founded at Manchester in July, 1930. Shortly after this date, the whole factory, including the school, was transferred to its present site at Dagenham. The trade school consists of an engineering shop, classrooms, library, dining room, laboratory and common room, all of which have been provided for exclusive use by members of the school. One hundred students are trained at a time and this necessitates a teaching staff consisting of the principal, two class lecturers, a shop supervisor and ten engineering instructors.

Considerable thought and care has been given to the method of selection of candidates, for experience over many years has shown that much effort may be wasted, both by the student and by the staff of the school, when a pupil is admitted who has little genuine interest in engineering as a career.

Only local school-boys between the ages of fifteen and fifteen years eight months are allowed to compete in the entrance examination. Boys who do not live within the residential area surrounding the factory cannot be considered, for even with this restriction, the number of candidates far exceeds the number of vacancies available The first task is to reduce the applications to a manageable number and this is achieved by a preliminary examination which consists of intelligence tests, technical aptitude papers and a test in elementary arithmetic. School achievements are not considered at this early stage of selection, but school records and successes are discussed at a subsequent individual interview of all candidates who survive the preliminary examination. The marks obtained in these tests are adjusted so that least importance is attached to arithmetic and greatest importance to the technical aptitude papers. Candidates with the highest total marks are accepted for a second series of tests; the remaining candidates are rejected.

The final examination consists of



The "Cut-away" shop where boys are working on a tractor engine which will be used for exhibition and demonstration purposes. In the background an instructor and student are making a component in plastic

an individual interview of each candidate together with a further series of tests. The candidate is tested with models and diagrams which involve simple mechanical movements whilst other tests demand clear geometrical thinking ability, often in three dimensions.

The course lasts for four years. For approximately the first two years, all students spend two days in the classrooms and three days in the school shop. During the remaining two years, students who have the necessary academic ability spend one day in the company's classrooms and one day at the local technical college, where they study for a suitable engineering qualification—generally the National Certificate in Mechanical Engineering. The remaining senior students—those who are better at practical work than at class study—spend one day in the company's classrooms and four days a week at practical work.

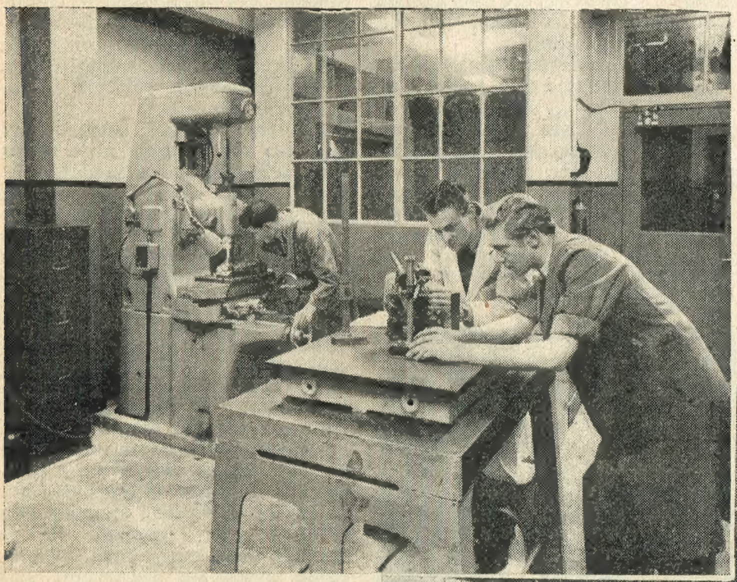
Students are paid on an hourly basis for all time spent in the school, whether in class or shop and, as with all company employees, they receive normal pay for two weeks' summer vacation and for all statutory holidays. The commencing rate of pay is 1/8½d. an hour at age fifteen and this increases each succeeding birthday to 3/1½d. at age nineteen. Subsequently, the rate of pay increases rapidly to the adult rate for a skilled worker at age twenty-one.

The day's activities commence at eight o'clock in the morning and, as has long been the practice for all members of the Ford Motor Company, students work a five-day week. In the engineering shop, work finishes at 4.30 p.m.; in the lecture rooms students leave a little earlier as six hours of theoretical work is considered sufficient for one day. An hour of organised physical recreation follows class activities as part of the syllabus on one day a week. There are breaks for refreshments in the middle of each morning and afternoon, and lunch is provided free of cost to the students. In order to encourage the habit of thrift, each student is presented with a National Savings certificate every twelve weeks. Students are encouraged to purchase additional certificates by regular deductions from their wages.

No System of Indentures

The Ford Motor Company does not bind its students by legal indentures. Every student is free to leave, either during the school course or subsequently, for it is felt that good training, pay and conditions form a better method of attraction than legal coercion. The class-room curriculum is designed to give a broad basic training with special emphasis on technical subjects. English, machine drawing, shop theory, mathematics and mechanics are continued throughout the four years. Junior students are given a good grounding in elementary arithmetic, which develops into the study of logarithms, mensuration and trigonometry. Science is approached from the historical and cultural angle whilst geography is considered mainly from its commercial aspect.

Towards the end of the second year, students commence a one-year course in civics and, a little later, courses on elementary metallurgy and electrical engineering. A well-equipped mechanics laboratory not only helps students to understand this important subject but also to appreciate the value and the importance of experimental methods. Visits are arranged to other works and industries. Guest lecturers are invited to talk to students and special exhibitions and displays are occasionally organised in the department. These exhibitions cover a wide range of interest, such as hobbies, various forms of art, book displays, printing, stamps, coins and photography. Film shows are arranged regularly



Left: A student testing a gauge made in the school for use on the tractor injector system, while an instructor looks on

Below: A general view of the main machine shop

every four or five weeks. With the co-operation of the local education authority, weekend conferences are occasionally held at a county residential guest-house. Films, lectures and conferences are planned to cover a wide variety of subjects, such as history, travel, psychology, art, music, economics, literature, sport and hobbies.

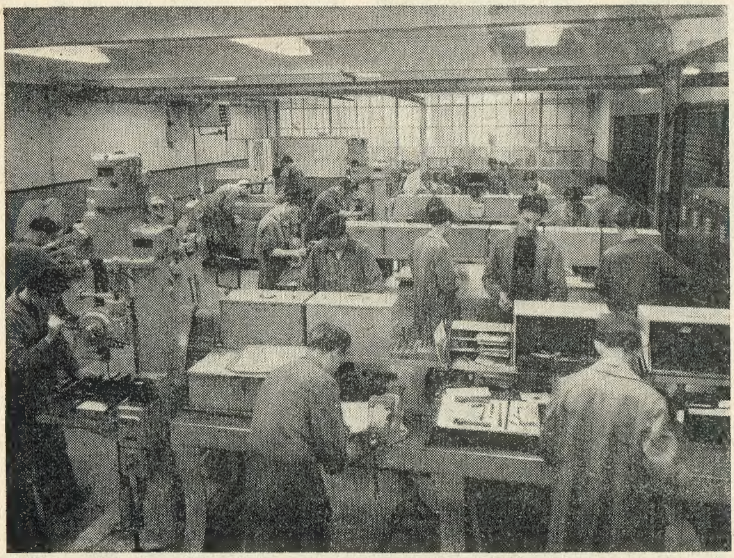
The trade school library contains three thousand five hundred books, embracing the most diverse range of subjects, and there is an additional collection of eight hundred fiction books.

First-class machine tools are installed in the school machine shop and these are used exclusively for training purposes. All machines are kept in excellent mechanical condition by the students themselves, under the supervision of an experienced maintenance instructor. Valuable experience is gained in this way in maintenance operations such as scraping, fitting, gear cutting and many other workshop processes. When no work of this kind needs to be done on school machinery, the complete overhaul of a suitable machine from another department is undertaken.

The equipment of the machine shop consists of seven engine lathes, a turret lathe, a capstan lathe, an instrument lathe, two universal mills, three plain mills, two vertical mills, a precision jig borer, a slotter, four shapers, four surface grinders, a rotary surface grinder, three universal cylindrical grinders, an internal grinder a cutter grinder, three universal tool grinders, four gauge grinders, four pillar drills, a radial drill, a power saw, a filing and sawing machine, three oxy-acetylene welding positions, an electric welding booth, a spot welder, sheet metal machines, portable rotary equipments, tool grinders and a heat treatment furnace. There are, of course, many items of small equipment, and there is a fully-equipped tool store.

A new boy first works at a simple job on a bench or he stands alongside a machine which is being operated by a senior student. He then proceeds to more difficult work on a bench or he may be allowed to operate a lathe or a shaping machine. As far as is practicable, the difficulty of the work increases with the student's experience, confidence and knowledge. The importance of safety in the machine shop is emphasised from the first day, for the natural curiosity of an enthusiastic student towards machinery could readily lead to serious trouble. There has not been a single case of a serious accident in the history of the school.

Limited use is made of test pieces or other exercises as a method of practical training. The majority of the work consists of manufacture of tools, gauges, jigs and experimental parts, the repair of clock indicators and other precision instruments and many other skilled activities which would not fit conveniently into the routine of other departments but which form a useful service to the factory. Another important activity is the preparation and assembling of parts for cut-away demonstration engines, vehicles and tractors which are used for display at exhibitions and for educational purposes by technical colleges and other authorities. A considerable amount of experimental work has been carried out in the school on the casting and machining of automobile and tractor parts in coloured plastics, Perspex and other unusual engineering materials.



The Basic Training shop where students are given a six months initiation course into engineering processes

Development of Skill

Senior students are able to make complicated jigs and fixtures which in some cases have been designed in the school. Operations requiring accurate measurements, frequently to a ten-thousandth of an inch, are not uncommon, and for this purpose, sets of Johansen gauges, accurate comparators and many other precision measuring devices are available. No jobs are accepted by the school which do not give scope for the development of engineering skill. Students are not allowed to contribute in any way towards the manufacture of components which are used directly in vehicle construction or parts which are sold on a commercial basis.

All trade school students are members of the company's sports club, which provides facilities for almost every kind of sporting activity, and the trade school football and cricket teams take active parts in local league matches. Organised swimming and life-saving classes are held during the summer.

A student who has successfully completed the course knows the capabilities of the majority of the types of machine tools found in an up-to-date tool room and he is able to operate many of these machines with a reasonable degree of skill. He is able to read engineering drawings intelligently and he can make his own drawings and sketches when required. He is familiar with many kinds of precision measuring instruments and he is able to work out his own calculations. He is equipped with a broad theoretical training; he has a good working knowledge of a number of technical processes; he has learned how to avoid accidents and he knows how to treat machines and instruments with care.

By the time a student has finished the four-year course of training he usually has a good idea of the direction in which his interests and talents lie. As far as possible, he is transferred to a department of the factory where his capabilities may best be utilised.

READERS' LETTERS

● **Letters of general interest on all subjects relating to model engineering are welcomed. A nom-de-plume may be used if desired, but the name and address of the sender must accompany the letter. The Managing Editor does not accept responsibility for the views expressed by correspondents.**

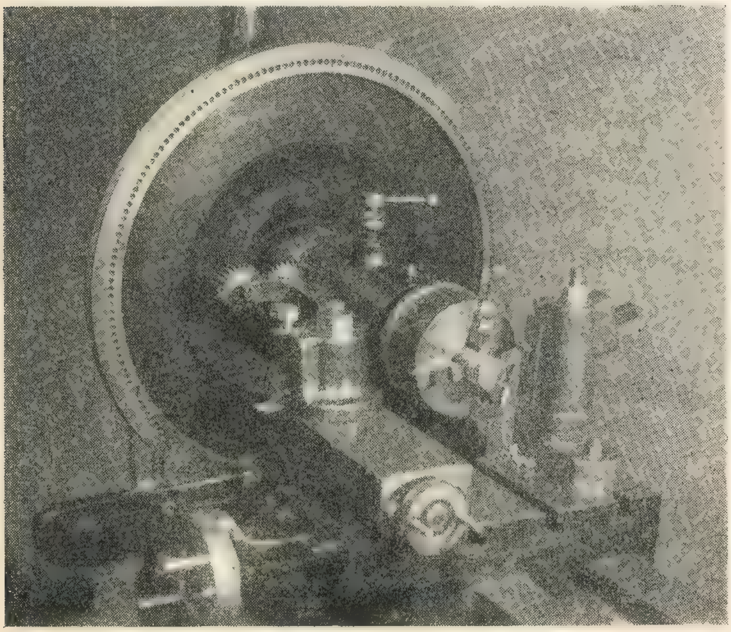
BACK CUTTING-OFF TOOLPOSTS

DEAR SIR,—In your issue for March 5th, 1953 you published my drawing of a proposed cutting-off back toolpost for holding a parting tool at 16 deg. top rake in place of the more usual horizontal position. Shortly after publication, the toolpost was finished, and the photograph reproduced herewith shows, it on place on my Exe lathe. I wish to make no exaggerated claims for this design, but it has come up to my expectations in every way and I recommend others to try it. In the photograph, the tool is cutting into a piece of $\frac{7}{8}$ in. round steel, the swarf coming off in long curly ribbons. There is no difficulty in parting-off brass, either. The Exe is a well made lathe with a bed more massive than many modern 4 in. tools, but it certainly jibs at parting-off steel if there is no top rake on the parting tool.

I was particularly interested in the Marine Vapour Engine Co.'s motor, as I, too, have two engravings, one showing a 30 ft. launch, and the other a much fuller sectional view of the engine, which is evidently an improved version of that, shown on page 719. The engine in my description (*English Mechanics*, Vol. 65, 1897) is referred to as a Wright engine of 7 h.p. The condenser consisted of 50 ft. of copper pipe along the bottom of the boat and from there the condensate passed to a copper tank in the stern. The alcohol pump eccentric is within the crankcase, so presumably any drippings from the gland would fall into the crankcase and together with any vapour that might pass the pistons, somehow pass away to the exhaust. The rear bearing has a gland, and external to this is an eccentric for the whistle air pump and kerosine pump. I believe that a very great objection to this type of engine is that the lubricating oil is destroyed by the alcohol vapour.

Yours faithfully,

Swansea. H. E. RENDALL.



CUTTING LUBRICANTS

DEAR SIR,—In the issue of October 29th, I notice in "Queries and Replies" on p. 532, you advocate the use of carbon tetrachloride as a cutting lubricant for stainless-steel. This liquid is, of course, highly toxic and hence dangerous. With caution and good ventilation, small amounts may be used for short times without excessive danger, but any use of this material on a considerable scale is definitely dangerous and I feel that a note to this effect should have accompanied your reply to this query. I believe that its use, in large amounts or small, is banned by the Factory Safety Acts, incidentally.

Yours faithfully,

Wirral. "ARTY."

HYDROCARBON VAPOUR ENGINES

DEAR SIR,—With reference to the article on the above subject in the December 10th, 1953 issue, a sectional arrangement drawing of the naphtha power plant appears at Figs. 194 and 195 of the book by Giorgio Croppic entitled "Il Canottagio" (Milan 1898). The book is in the Patent Office Library.

Yours faithfully,

London, S.W.6. G. F. BRUTON.

IGNITION PHENOMENA

DEAR SIR,—In reply to Mr. Ahern's letter (THE MODEL ENGINEER, November 26th), I wish to say that I can think of no reason why the actual "oiling"-up of sparking-plugs should depend on spark polarity, unless electrically charged particles of oil or petrol are present in the cylinder. The petrol droplets in the mixture would be charged negatively by friction at the carburettor jets.

Mr. Waterton suggests (THE MODEL ENGINEER, October 22nd) that the plugs of Mr. Curwen's engine (THE MODEL ENGINEER, September 3rd) were "oiling"-up irrespective of spark polarity, but that the spark would pass more easily if the insulated electrode of the plug became positive to the cylinder, or would pass in that case only.

My theory (THE MODEL ENGINEER, October 29th and above) suggests that performance is best when the central electrode is negative: Mr. Waterton's theory suggests the reverse. If Mr. Curwen could kindly assure us of the facts, i.e., best polarity measured at *plug*, the issue would be decided, unless a further theory emerges.

Yours faithfully,

Cardiff. B. TROTT.

MORE UTILITY STEAM ENGINES

A Double Tangye Type Mill Engine

By Edgar T. Westbury

THE crankshaft for the double engine is in some respects simpler to construct than that employed in many single-cylinder engines, but nevertheless it demands care in machining and assembly to ensure the accuracy which is essential to mechanical efficiency. It will be seen that it is fabricated from five separate parts, and even if one wished to machine it entirely from the solid, it would be impracticable to do so, unless the flywheel, eccentrics and other components mounted on the shaft were also made integral with it.

The main journal of the shaft is a straightforward turning job, which can be carried out between centres. It has an enlarged seating for the flywheel in the centre, following the usual practice for engines of this type, though as this feature is not visible, the construction could be simplified by making the shaft diameter the same throughout its length, except the extreme ends. This would detract neither from the appearance of the engine, nor from its practical efficiency; if constructors decide to take this course, I suggest that the shaft should be ½ in. diameter, as there is plenty of room in the bearing housings to bore out the split bushes to this size. This would result in a very rigid and sturdy shaft.

Continued from page 69, *January* 21, 1954.

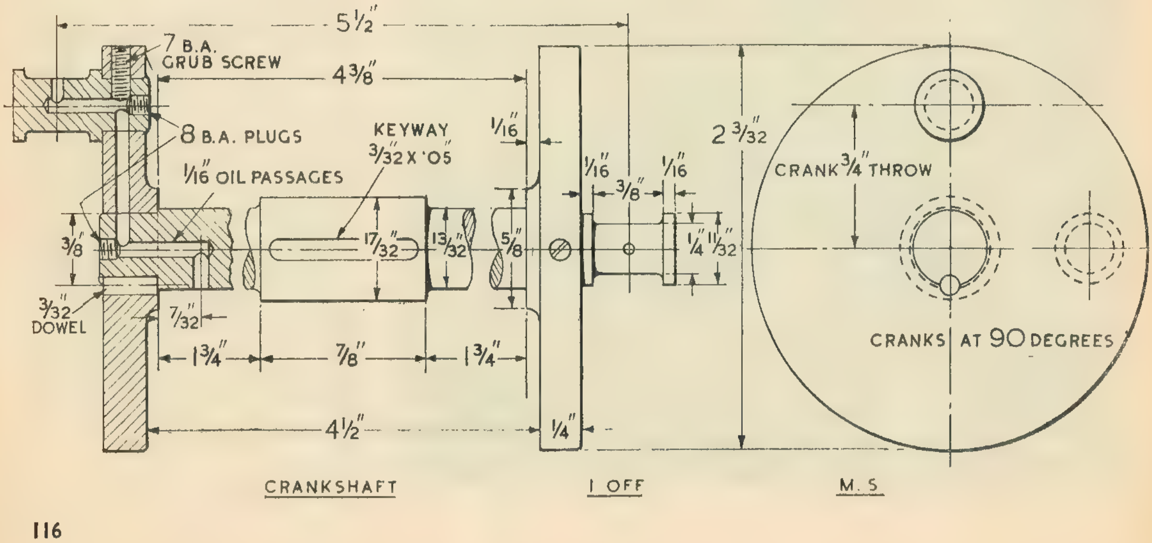
In turning an engine shaft between centres, it is essential to see that the lathe centres are in good condition and that the live centre runs perfectly truly; if a soft live centre is used, it can be trued up *in situ* before mounting the shaft. The latter should be centre-drilled deeply to give an adequate bearing surface, but the pilot hole, for a shaft of this size, should not be larger than $\frac{1}{16}$ in. diameter, particularly in view of the fact than in this case the shaft ends have to be drilled for oilways, and tapped out at the mouth for plug screws. It is a good policy to carry out the drilling, but not the tapping, at the same set-up as the centre-drilling, to ensure concentricity of the holes; about $\frac{1}{16}$ in. or so extra length should be allowed on the shaft at each end to take the countersink of the drill, and trimmed off after other turning operations are finished.

The working surface of the journal should be turned to a smooth and accurate finish, straight from the tool if possible, but if not, a ring lap may be used to correct minor irregularities, errors of parallelism, or dimensions. It is advisable to leave the final sizing of the crank disc seatings until the discs have been bored.

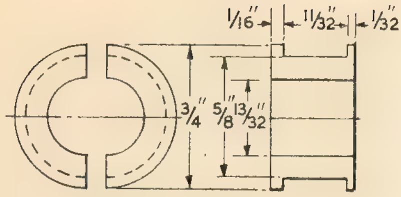
Crank Discs

These should preferably be made from slices of mild-steel bar, though cast-iron is a permissible substitute, if due care is taken in the fit of the journal and crankpins to avoid risk of fracturing the more brittle material. After facing the two sides of each disc to ensure that they are parallel, the discs may be sweated or clamped together for boring the journal and crankpin seatings. These operations should be carried out by mounting them on the lathe faceplate, to avoid risk of side error, and afterwards the discs may be separated, and individually mounted on a mandrel for completing the facing of the front and back, and turning the outer diameter.

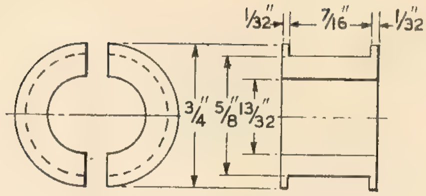
An alternative method of machining the discs, which may be preferred if castings are used, consists of individually facing the back, turning the boss, and boring the centre at one setting, then mounting on a stub mandrel for facing the front



CRANKSHAFT 1 OFF M. S



OUTER MAIN BEARINGS
2 OFF BRONZE



INNER MAIN BEARINGS
2 OFF BRONZE

and turning the rim. An eccentric mandrel is then made or improvised, such as by mounting a bar in a Keats vee-angle plate and turning the end to fit the bore of the discs, then setting the fixture over ¾ in. out of centre. As it is not desirable to use force in fitting the discs on the mandrel, it is advisable to provide a shoulder to locate the disc, and a nut on the end to hold it in position. One of the discs may be marked out to locate the crankpin centre, and centre-punched, as a guide to true setting-up of the assembly; when one disc has been bored, it may be removed and replaced by the second, without shifting anything else, so that equal throw of the two cranks is ensured. Although a slight error in the crank throw dimensions can be tolerated, as it can be compensated by adjustment of other working parts, it is obviously desirable that it should be uniform in the two halves of the engine.

Both of the bores in each crank disc should be smooth and true; the use of a reamer is permissible for finishing them, so long as it does not snatch or chatter, but roughness or inaccuracy in the holes is fatal to secure fitting. It is a good idea at this stage to drill the radial oil passage in the disc, which should be marked out to intersect the main and crankpin centres; and to ensure that it really does follow this path, the drilling may be carried out in the lathe, by clamping the disc on an angle-plate and setting it up so that the radial line is exactly square with the faceplate. Although further radial drilling will be necessary after assembling the shaft, this preliminary operation will reduce the difficulty and ensure accuracy.

Crankpins

These are quite straightforward to make, and may be machined at one setting from ⅜ in. mild-steel bar, and parted off. The journal should be carefully finished, with fillets in the corners, and the spigot should be turned to a light interference fit in the disc (about half a thou. oversize), also about 1/64 in. longer than the thickness of the disc so that it can be lightly riveted over at the back, after pressing it in with the aid of the bench vice, using the soft-jaws to avoid marking. As the central hole for the oil passage is also drilled at this setting, or at any rate, before insertion of the pin, care must be taken not to burr it up when riveting, but this is easily avoided by concentrating on the edges of the pin, with the hammer face slightly on the slope. The end of the pin should be supported on a pad of copper or aluminium for this operation, and care taken to avoid bruising the back of the disc or causing distortion by uneven hammering. Only light burring over of the spigot is necessary if it has been properly fitted.

Crankshaft Assembly

Before fitting the discs to the shaft, the keyway for the flywheel should be cut (unless other means of securing it are to be adopted); it may be made with closed ends as shown, by end milling, or open-ended, by side milling or planing. A further alternative would be a " half-moon " or Woodruff key, the standard ½ in. semicircular key being quite adequate for this job. It is, of course also practicable to key the eccentric sheaves, driving and governor pulleys, etc., if desired, using the same methods of locating the former as recommended for the " Unicorn " engine. I find, however, that most steam engine constructors have a deep-rooted objection to immutable fixing of the sheaves, preferring to use a method which enables subsequent alteration of timing to be made if found desirable; and I have, therefore, specified the use of concealed grub-screws for fixing them, though obviously this is not in keeping with full-size practice.

Final assembly of the shaft components is, of course, inevitably deferred till the above parts have been mounted on it. The ends of the shaft should be fitted to about 0.001 in. interference, and the discs should be " quartered," that is, one crankpin set 90 deg. in advance of the other, the usual arrangement being with the right-hand crank in the lead, though this is not rigidly observed, and indeed, may open up some dispute as to which *is* the right-hand crank ! As each half of the engine is complete in itself, slight errors in crank angles do not affect efficiency, so long as each eccentric is timed in relation to its adjacent crankpin, but the methods of quartering employed in locomotive axle assembly can be adopted with advantage, and have been described so often in these pages that they do not need to be repeated.

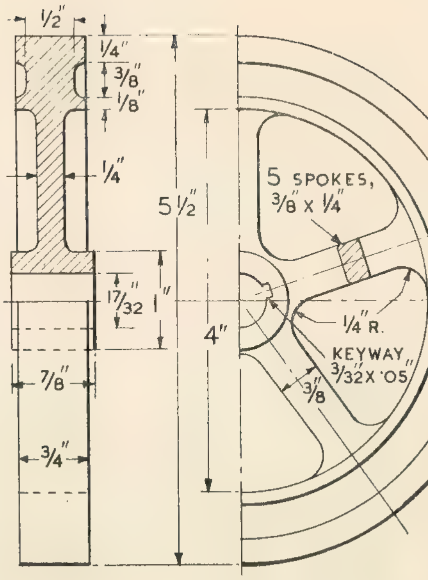
Some kind of press is desirable for forcing the discs on to the shaft, as the length is greater than can be accommodated between the jaws of the bench vice, unless it is of very large capacity. It is often possible to improvise or press into service some item of equipment such as a carpenter's floor cramp for this purpose, but care must be taken to apply true axial pressure, and avoid any tendency to tilt the discs out of truth, as this may cause permanent inaccuracy. The operation may be started in the lathe, using the tailstock, with a drill pad in the socket, and before proceeding further, the quartering of the cranks should be checked, while any necessary correction is still possible; the shaft can then be transferred to the press, and the two discs simultaneously pressed home.

Although in full-size practice, keys would be fitted to preserve the angular location of the discs, I have specified dowels, as they are easier to fit, and perfectly satisfactory. The holes are in opposite phase to the crankpins, and drilled axially on the intersection of the shaft and disc, or " half-and-half " as our foreman used to say; undersize holes, say No. 44, should first be drilled, and then opened out to

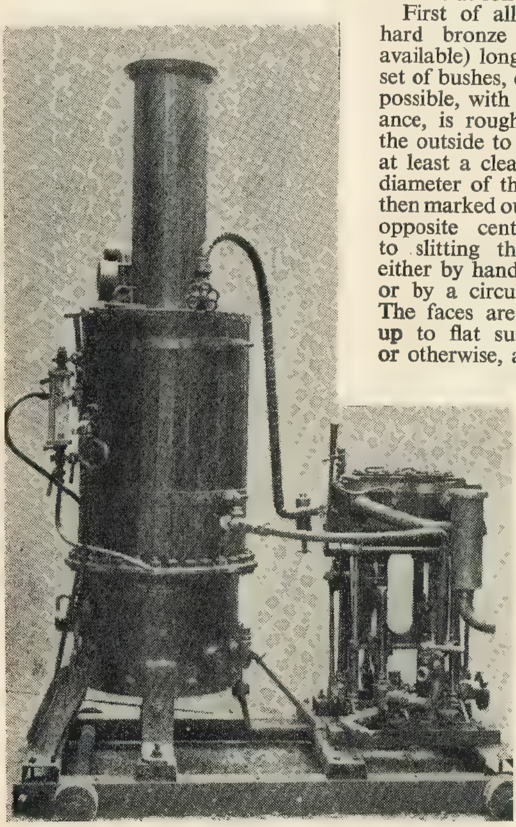
3/32 in., or to the dead size of the particular rod used for the dowel, whatever it may be. Do not attempt to "improve" the tightness of the fit by using an oversize tapered dowel; it will only result in forcing the disc out of truth, and will probably fall out later on, anyway! A parallel dowel, fitted to tap in lightly, will be most satisfactory.

The radial oil passages through the diameter of the crankpin, and into the centre of the shaft, can now be completed, and the ends of the holes tapped and plugged, making the plugs a tight fit on the thread so that they can be screwed tightly home and trimmed off flush with the surface. It will be seen that the plug in the radial hole is of larger diameter than the other two, and passes well into the crankpin, so as to form a safeguard against any turning movement, though this should not be really necessary. This screw may have a slotted head, enabling it to be removed for clearing the passage if required. Make sure the passage ways are clear, by syringing paraffin through them, before passing the assembly as "O.K."

It is, of course, necessary to use split bushes in the four main housings, and similar split bushes are optional fittings in some other working parts of the engine. These items can, and often do, give a good deal of trouble in machining, quite out of proportion to their apparent importance in the scheme of things, and I generally prefer to dodge them whereever possible! However, when it is really necessary to fit them, the method I employ in making them is as follows:



FLYWHEEL 1 OFF. C.I.



Mr. Phare's steam plant for a 20-ft. launch

First of all, a stick of medium hard bronze (or lead bronze if available) long enough to make the set of bushes, or as many of them as possible, with extra chucking allowance, is roughed down parallel on the outside to a size which will give at least a clear $\frac{1}{16}$ in. over the full diameter of the bush flanges. It is then marked out to give diametrically opposite centre-lines as a guide to slitting throughout its length, either by hand with a fine hacksaw, or by a circular saw in the lathe. The faces are then carefully trued up to flat surfaces, by machining or otherwise, and the halves tinned, prior to sweating together under pressure to ensure close contact.

It is now possible to chuck the piece in the four-jaw chuck so as to centre the division line, and to machine each bush inside and out before parting off to finished size. When drilling, be sure to use a keen drill, with moderate feed, to avoid risk of forcing the halves apart, or overheating. An under-size drill should be used, in case of a tendency for it to run out ot truth, and the hole opened out to size with a boring tool—reaming is not advisable, though a sharp D-bit could be used for taking out the last "couple of thou." Machine the outside exactly to the same diameter as the housing, and make the flanges or cheeks to a close fit over the ends of same. After parting off, it is permissible to re-chuck in the self-centring chuck for light operations such as skimming the face, or chamfering the bore (with a single-point tool). Before heating up to separate the halves, make identification marks on the edges of cheeks to ensure correct order of assembly.

The flywheel is of distinctive design, having five spokes of rectangular section with unusually wide "flare," or large-radius fillets, where they join both the hub and the rim, and the latter has side grooves similar to those of the "Unicorn" flywheel, but it is more massive, and wider on the face. The machining methods employed in the former case are quite applicable, but as the casting is less fragile, it may be found unnecessary to steady the rim by bolting it against the faceplate. As before, the machined surfaces should run dead true all over, and final finishing on its own shaft, or a true mandrel, may be desirable. The keyway can be planed out in the lathe.

Although I have not been able to examine any full-size engines of this particular type, and am, therefore, unable to state definitely what methods were employed to transmit

the drive to the plant or equipment to which they were applied, it is highly probable that, in common with the majority of mill engines, some examples of them at least, employed multi-rope drive, the face of the flywheel having a number of vee grooves to take the ropes. I should imagine that about six grooves would be appropriate for this type of engine, but in the absence of more definite information, I hesitate to make any statement on the matter.

From the purely practical point of view, assuming that the model is to be used for driving machinery—a dynamo, for instance—it would probably be preferable to use a single flat belt, in which case the more appropriate shape for the flywheel rim would be slightly convex, or "crowned." It all depends just how the individual constructor interprets the term "utility" as applied to engines in this category, and to what extent it justifies departures from true prototype practice.

Appreciation

Perhaps these acknowledgments may be a trifle belated by the time they appear in print, but I would like to express my sincere thanks to the many readers who have sent me messages of goodwill and encouragement during the Festive Season. As I have been suffering from seasonal complaints (not, however, the kind referred to by "Mrs. Model Engineer" in the December 10th issue !) I have not been able to acknowledge them all individually, but they have, nevertheless, been duly regarded and appreciated. These messages have been received from all the corners of the earth; some from old friends, some from readers with whom I have corresponded in the past, and not a few from readers hitherto unknown to me. However, all are heartily welcomed, and it is highly gratifying to know that these articles have won for me such a wide circle of friends.

I was particularly interested in the card received from Mr. H. Phare, of Torquay, which contains a photograph of his marine steam plant, now installed in a 20 ft. boat. It comprises a Merryweather vertical solid-fired boiler, and a Mumford compound condensing engine, with cylinders $2\frac{1}{2}$ in. and 5 in. bore respectively, by 4 in. stroke. At a working pressure of 100 lb. per sq. in., it develops 6 h.p.

(To be continued)

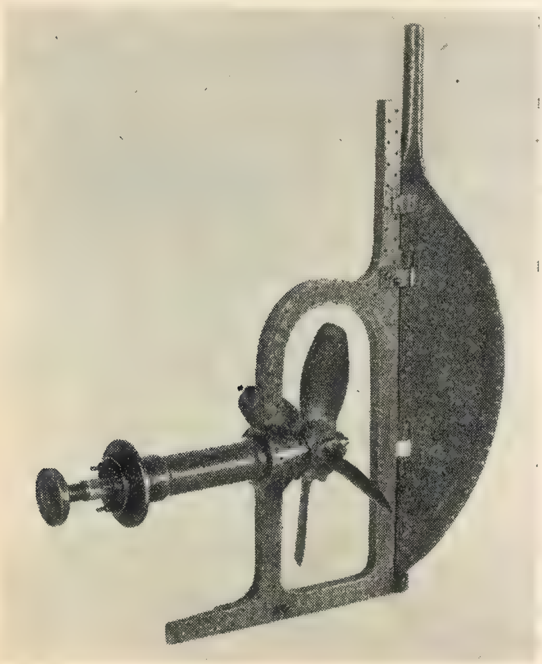
A MODEL STERNPOST ASSEMBLY

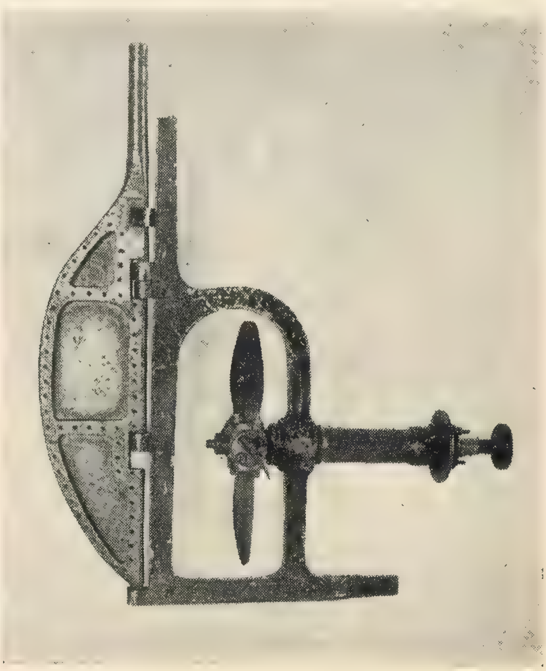
By Ian Bradley

THE two illustrations that accompany these notes depict a model of a ship's stern post and rudder complete with the propeller, shaft and stern tube. This model, together with some other engineering effects, was bought at a local auction sale. Nothing was known of the model's origin; however, in view of the detail included, it seems likely that it was made in a shipyard, either to illustrate some particular point in construction or, perhaps, to substantiate a claim in a court action for patent law infringement.

It has been found difficult to date the model; in fact, so far, no one will commit themselves on the point. As will be seen, the blades of the propeller are detachable, and it is interesting to note that the stern tube is actually fitted with segmental hardwood bushes. The steel propeller shaft carries a pair of well-fitting bronze sleeves shrunk in place, and these sleeves run in the hardwood bearings previously mentioned.

If any readers can identify and date the model, it will be most helpful to at least one other reader.

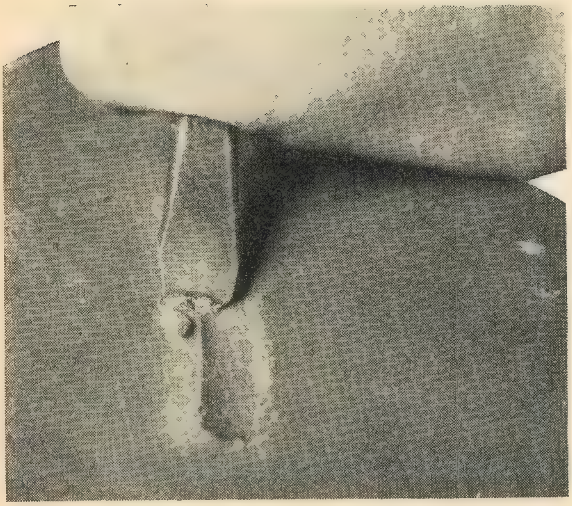




BRUTE FORCE.... and INTELLIGENCE

NOTES ON THE USE OF CHISELS

By A.E.U.



Photograph No. 1. Cowmouth or Bullnose roughing out. Note that curved cutting edges of the chisel emerge at the edges of cut

IN these days of machine tools for every conceivable machining operation, the continued use of the old combination of hammer and chisel would seem out of place. But the chisel is a very useful tool in the hands of a craftsman; it can rough out shapes not possible with simple machines, or remove surplus metal prior to filing or scraping when no machine is available.

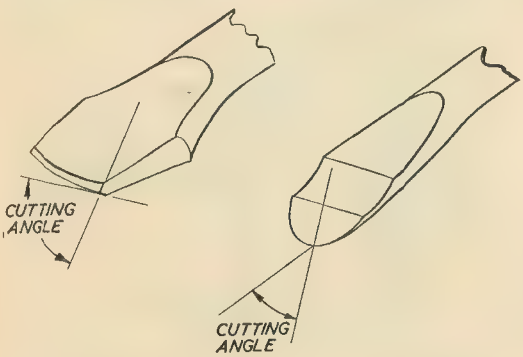
Chisels can be quite small, some requiring only a 4 oz. hammer to drive them. Apart from oilway cutting, chisels can be very useful when cutting parts from solid bar instead of using castings. The chisels I most frequently use are the " cowmouth " or " bullnose," and the flat chisel. A narrow version of the cowmouth is used for oilway cutting. The bulk of surplus metal is removed with a cowmouth, which is best for deep cutting. The ability of the cowmouth to cut deep is dependent upon the curved cutting edge emerging above the surface of the workpiece (Photograph No. 1). The flat chisel is used to smooth surfaces that have been roughed with the cowmouth, or any cutting where it can cut with its extreme edges clear of the cut. Another use of the flat chisel is cutting sheet material in the vice, using the vice-jaws as shearing edges. If it is desired to cut an aperture in this way, a small hole should be drilled in the corners of the aperture to enable the chisel to start without causing too much distortion of the work. The cutting edge of the flat chisel should rarely be straight, but should be slightly curved.

Never use a chisel that feels clumsy, or too large for the job; best results are obtained with a chisel just about big enough for the job in hand.

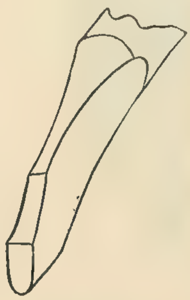
Too large a chisel will absorb too great a proportion of the impact of the hammer. For heavy cutting, the edge of the chisel should be wiped with an oily rag. If cutting aluminium, the chisel edge should be stoned smooth, to resist the efforts of the " alley " to adhere to the cutting edge, and so retard the chisel. A steady succession of blows, uniformly struck, allows full control of the chisel, and is easier on the arm and wrist. It is best to use a hammer heavy enough to make the chisel cut with a light blow. If you miss, or strike the chisel a glancing blow, you won't do much damage on the follow-through of the blow. If, however, you are " belting " the chisel, and miss, you will develop a remarkable talent for workshop esperanto ! Note—when cutting oilways it is best to line out the oilway in pencil or chalk first, and to cut all parts of the oilway in one direction first and join up as a second operation (Photographs 3 and 4).

Cutting Angles

These depend on the material being cut, and the preference of the user. For the softer metals, an included angle as acute as 60 deg.

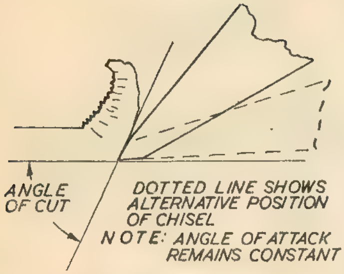


Cutting angles of flat and cowmouth chisels

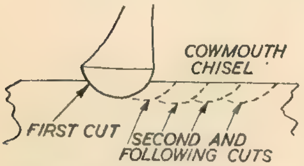


Oilway chisel

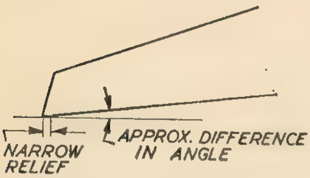
Photograph No. 2. Same work-piece as photograph No. 1 with chisel removed



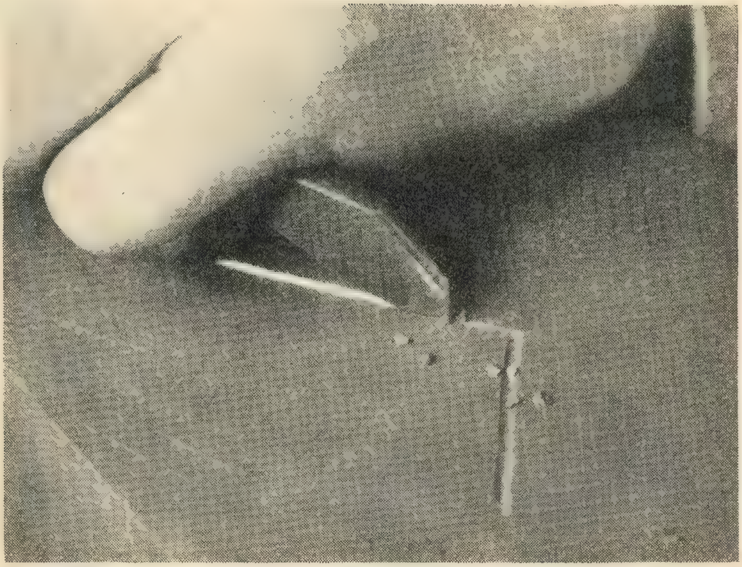
Angle of cut or attack



Roughing out with cowmouth



Section of assymetrical chisel



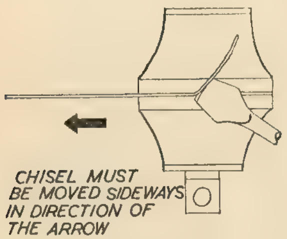
Photograph No. 3. Cutting an oilway with a chisel. Note chalkline in front of chisel to indicate the line of cut (apparent chalkline behind chisel is due to intense reflection from newly-cut oilway)

can be used; for steel and cast-iron a shade less than 90 deg. can be used. Just how much less than 90 deg. depends upon two factors; whether frequent regrinding of the chisel, or the effort to drive it, is more important, e.g., the more acute the edge, the less effort is required to drive it, but regrinds are more frequent.

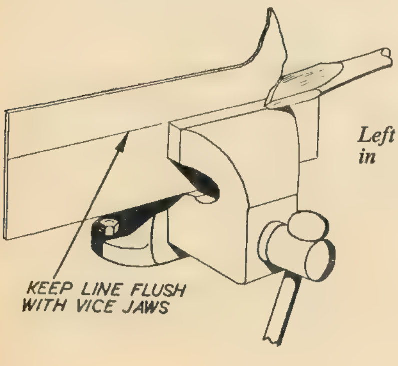
The cutting edges of a chisel do not have to be symmetrical about the centre-line, but can be disposed about the centre-line in any manner that suits the job, so long as the included angle remains the same. The angle of attack will then remain constant.

NOTE.—It is most important that the depth of the cutting faces, from edge to relief, should be kept narrow so as to allow control of depth of cut. For chisels used one way only—cowmouth, oilway or flat chisels ground assymetrically, the bottom edge, when in use, should be narrowed only (see sketch).

I have not described the manufacture of chisels, as quite excellent ones can be bought, and the tempering of chisels is a tricky business, as the dividing line between too soft and too hard is finely drawn.



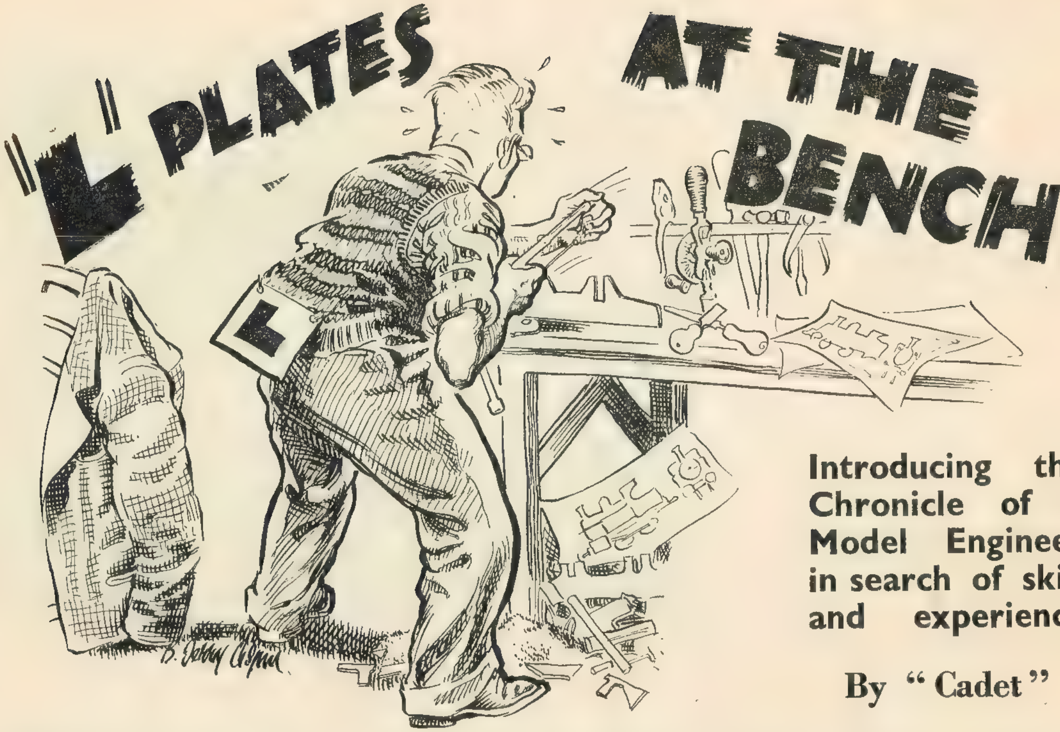
Bird's eye view



Left: Cutting sheet in vice with flat chisel

Photograph No. 4. Same oilway as photograph No. 3 with chisel removed

"L" PLATES AT THE BENCH



Introducing the Chronicle of a Model Engineer in search of skill and experience

By "Cadet"

GENERALLY speaking, model engineers can be divided into two classes; those who are "born" and those who are made. We all know the "born" type. Lock him in an unfurnished room with a coil of wire, a length of screwed rod, a couple of cocoa tins and a nail file; unlock the door after 24 hours and he will present you with a scale model of an oil refinery.

Let us raise our hats to him in respect as we pass hurriedly by on our way to the hobby's kindergarten. I shall feel more at home there and so, too, will those to whom this chronicle is addressed—the chaps with a little theory, a lot of keenness and not much experience.

Having had "workshops" in odd places, such as a dining room cupboard with let-down flap in a flat and, on another occasion, being reduced to a folding table and various boxes, I really came into my own recently when we moved into a house with an 18 ft. by 10 ft. garage. This is all mine, apart from a space just inside one door, about 5 ft. by 5 ft; this area is intended as a "park" for the following: one full-size child's tricycle and one baby-size tricycle, a push-chair, a wooden horse, a doll's pram, buckets, spades and boats (the sea being just down the road).

Having allocated said space for all this impedimenta, the imaginary lines of demarcation were observed for a time, but gradually things "crept" and I began falling over various toys in places where they had no right to be. So, on a recent Sunday, I announced at the lunch table that there would be a parade in the workshop at 1400 hours for a lecture. All must attend. Around the stated time there were assembled: wife (one-time WAAF sergeant and, therefore, N.C.O. i/c parade); daughter Felicity Jane, rising seven; son Leigh, recently three; and Killer Bones, the wire-haired terrier.

I got 'em all in line and numbered-off, then proceeded to read the riot act regarding *Keeping the Workshop Tidy*, ending with the threat that any domestic articles found outside their zone would in future be flung in the garden. Although I heard sundry rude remarks as the "troops" rounded the corner en route to the kitchen, there has been a marked improvement, and up to the present nothing has yet had to be hurled into the garden.

On taking over the garage, the position was as follows: floor ankle deep in dust, dirt, rubbish and bric-a-brac; fixtures nil, apart from a high slatted shelf on the north wall; no electric light. The doors face west and there is only one window, leaded, 18 in. × 30 in., mostly minus panes, in the remotest corner of the south wall. On cleaning up the floor, the debris filled three tea chests and a dust bin. The concrete was found to be chipped, cracked or "bent" in various places and level hardly anywhere.

The structure is a 3 in. × 4 in. framework, with uprights every 2 ft. and horizontals at the same spacing. There is asbestos-type sheeting on the outside, but none inside. Whilst not improving the place from a weather-proof point of view, the lack of sheeting inside does leave all the joists available for fixing things thereto. As is usual, there are joists across the top of the building, just below the V of the roof, so all the odd lengths of timber, pipe, etc., can be neatly stowed away.

I got in a bit of a tizzy trying to decide whether to put some electric light in first, so that I could work late, or get some benches and racks up. Somewhere to put things and do things came first, I decided. As it was summer, the light could wait a while.

I had enough 3 in. × 4 in. by me to make a framework for a bench 6 ft. × 2 ft. but no boards for the top. So I rang up a recommended timber merchant in the nearest town and said that I wanted one board 6 ft. × 8 in. × 2 in. and two of the same length but only 1 in. thick. Oh yes! They could do that, and deliver almost at once. And the price? Ye gods, I nearly had heart failure. You may have had recent experience of buying timber; up to then I had not. I hastily stalled

"The riot act"

them off, hopped on the bike and went round to the village carpenter-cum-builder. Although his figure was not quite so astronomic, I decided that, perhaps I had been mistaken, in thinking that the other concern was run by Messrs. Grabbem and Grasp. Obviously I was out of touch. However, with a gulp I took the plunge.

While awaiting delivery of the boards, I ran up the framework without any snags arising, and after the boards arrived all went well until the last moment. Just when I was busy securing the top to the framework, son Leigh arrived and gave me a long message in his best Horace fashion.

All I could gather from his dissertation was that his mother wanted something or other. I went to find out what it was all about, came back to the workshop half an hour later and, as I thought, picked up where I had left off. But when I lifted the front 2 in. board into position for fastening in front, I discovered that I had firmly anchored the rear 1-in. boards without putting the packing-pieces underneath to level them up with the front board, then said, "Bother," or words to that effect.

I positioned the main bench against the south wall so that, with the one door open I could get the light coming in from my right, and I rigged tool racks and shelves on the wall above. On the extreme left of the bench I secured a small cupboard, which I had "in stock," to the upright and underside of the bench top. The cupboard is divided into sizeable pigeon holes and has a shallow drawer at the top which takes rules, dividers, calipers, etc.

Next job was to run up a smaller fitting bench and I made this from an odd assortment of timber I had in hand. As no violent work will be done on it, I lashed it to the uprights of the east wall. Another furnishing was originally bought at a sale with the kitchen in mind but, by the grace of the patron saint who looks after model engineers, it proved too cumbersome for that department. It is a 3 ft. × 2½ in. table which must have come from a butcher's shop because, although the top does not bear any chopper marks, it is thick and solid and painted in that peculiar cream you get in a meat shop. A deep drawer is set in one of the 3 ft. sides and one person can just, but only just, lift it.

(*Continued on page* 136)

"Pipe dreams"

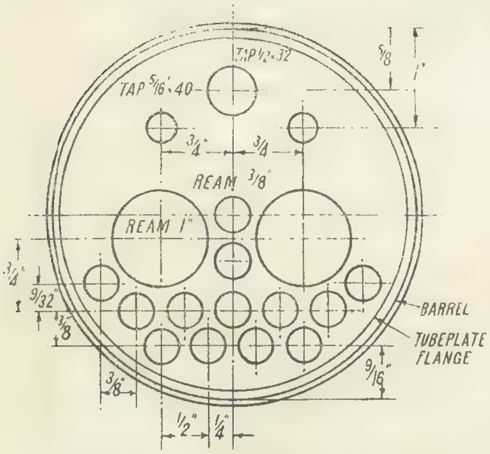
L.B.S.C.'s Titfield Thunderbolt

IN 3½ AND 5 INCH GAUGES

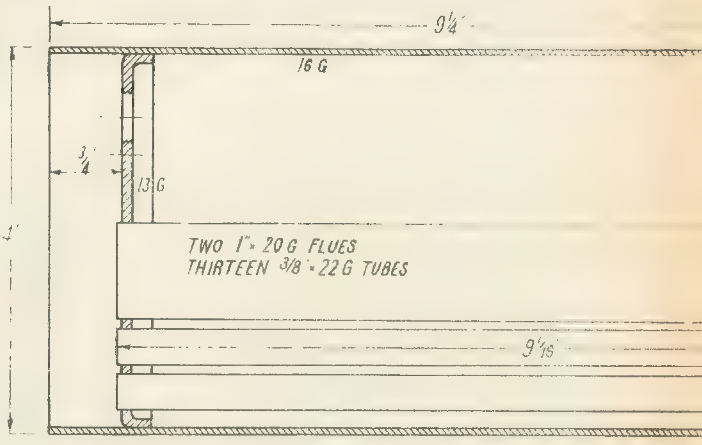
THOSE happy-go-lucky folk who fancy that they can build a 5-in. gauge boiler, merely by using the drawings of a 2½-in. or 3½-in. gauge boiler and increasing the dimensions, will get a bit of a surprise if they examine the reproduced drawings of the boiler for the 5-in. gauge *Titfield Thunderbolt*, and compare them with the similar drawings for the 3½-in. gauge job. The only real resemblance is the personal appearance ! For the start, the tubes and flues are the *same* diameter as those in the smaller one, but there are nearly twice as many of them. No " piston-ring " is needed at the joint between the barrel and the firebox casing, as the barrel can be fitted direct in the hole in the front; it cannot blow out, because the little bit inside can be flanged outwards sufficiently to prevent it, and a good fillet of brazing material, Sifbronze, or similar alloy, run around the lot. The firebox casing is made in a similar way to that on the 3½-in. gauge engine, the front and sides being made in one piece; the same type of backhead is used, also a cast dome, strengthened up in proportion to size. The staying is very different.

The good folk who pin their faith to rods, would have had to put a vast array of them between the crown of the firebox and the dome casting, making the latter look like a pepper-box, and naturally weakening it with so many holes. Also, very few of the holes could have been tapped at right-angles to the plate or casting. These rods would have wasted away in the middle of their length, and eventually snapped and let down the crown sheet. I know of several cases where this has happened. These rods would have been interspersed with another conglomeration of horizontal rods, the latter being necessary to prevent the sides of the firebox casing splaying out; the large flat surfaces would need plenty of support. How room would have been found for the regulator and pipes, is something that only the rod merchants know—or do they ?

Your humble servant certainly wasn't having any of *that* lark, as it is always my endeavour to make the job easy, and to ensure that the boiler is at the same time strong and safe. I couldn't use the ordinary type of longitudinal girder stays, splayed out as on the 3½-in. gauge engine, as the angle would have been too great; also an extra arched girder would have been needed in the middle, and that would have got in the way of the regulator barrel. I therefore combined the crown stays with the cross stays, by turning the girders sideways, or crosswise, just as you like, arranging them with side flanges to rivet to the firebox shell, small angles to rivet to the firebox crown, and specifying the whole lot to be brazed up solid. It is easy enough to drill the necessary holes in the cross girders, to accommodate the regulator barrel and the longitudinal stays, as you can see from the drawings. The firebox stays are the same size as those on the 3½-in. gauge engine, but much more numerous; and two extra stays are fitted from front to back of the upper part of the firebox casing, as I don't believe in what the kiddies call " chancing the ducks." The usual longitudinal barrel stays are fitted, one being hollow, to carry steam to the blower jet in the smokebox.



Smokebox tubeplate (5-in. gauge engine)



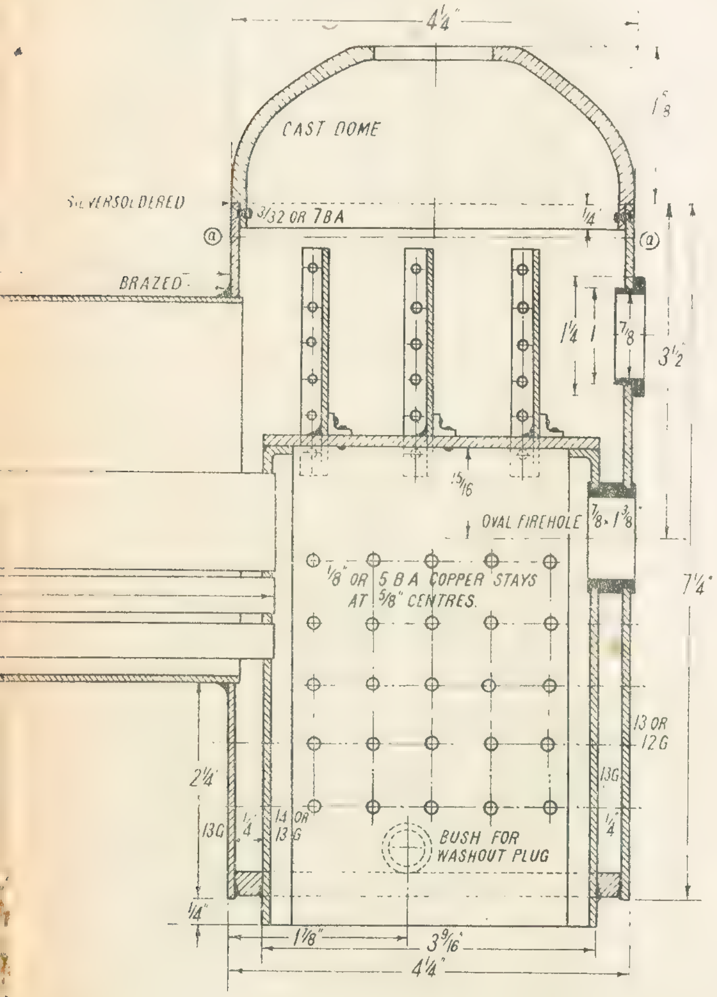
Several readers who are not very hot at coppersmithing, have written in to ask if it wouldn't be possible to use the ordinary type of boiler,

with a dummy Gothic dome on top of the firebox wrapper. Well, it *would* be, but I wouldn't advise it, for two reasons. One is, that it is a sin to waste all the extra steam space provided by the big dome, which renders the boiler more stable in operation; secondly, there is just as much, or even more work involved, than in making the boiler as I am specifying. Besides—what about our old nighthorse Inspector Meticulous? Well, that's enough preliminary rigmarole—let's get on with the job.

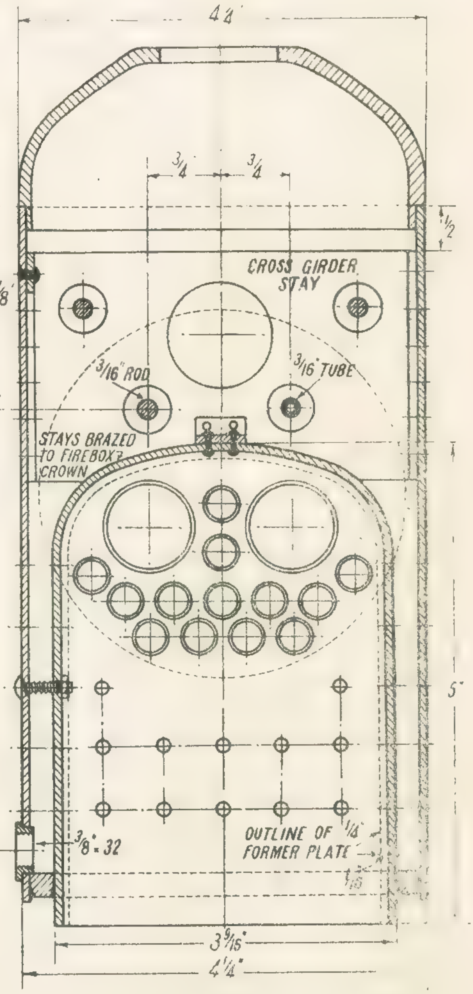
Boiler Barrel and Firebox Shell

The best thing for the boiler barrel is a piece of seamless copper tube, 16-gauge, 4 in. diameter, with both ends squared off in the lathe, to a length of 9¼ in. A 16-gauge barrel is plenty thick enough for this job, being short, and the only holes in it are the small ones for feed clack bushes. It can also be rolled up from 16-gauge sheet copper, in a manner similar to that described for the 3½-in. gauge boiler. Clean the inside of one end, and the outside of the other.

For the firebox casing, you'll need a piece of 13-gauge sheet copper, measuring 12¾ in. × 7¼ in. Bend this into a channel shape, end and sides measuring 4¼ in. and leave the corners rounded. At 4¼ in. from the bottom of the front part, cut a hole 4 in. diameter, by any of the methods I have previously described; the barrel should fit tightly into this, and project about $\frac{1}{16}$ in. through. Line up the barrel with the casing, and then braze it in, using the same method as described for the smaller boiler; leave a good fillet all around the outside of the joint. If the barrel has been rolled from sheet copper, the longitudinal seam can be brazed at the same heating. Pickle, wash off, and clean up; then carefully hammer the little bit of barrel projecting through the casing, outward and down, in the same way as the flange of the firehole ring. It needn't be bashed right down against the casing, but will be O.K. as long as the end of the barrel is made too big to pass through the hole. This little precaution, plus a good fillet of brazing material on the outside, wouldn't allow the barrel and casing to part company in a million years;



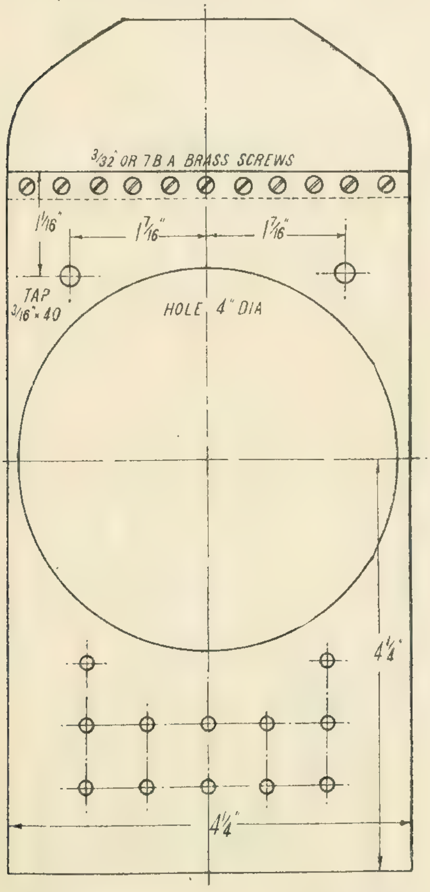
Longitudinal section of boiler



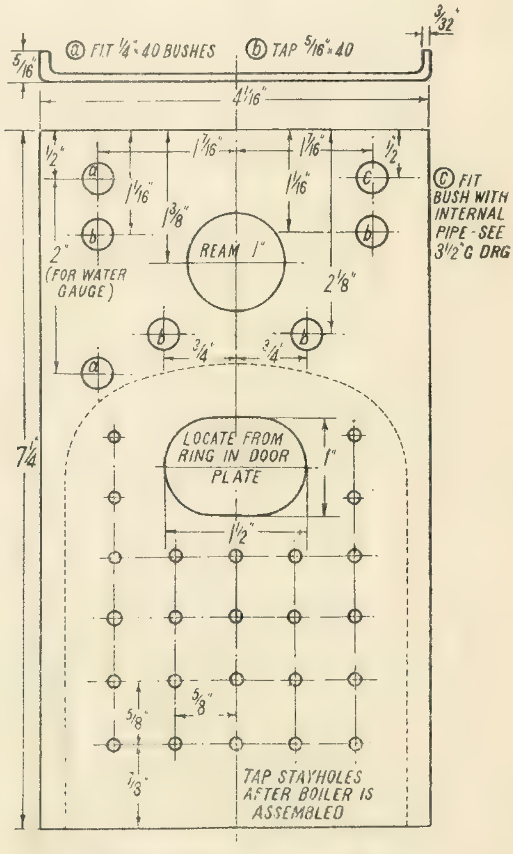
Cross section through firebox

it is certainly more satisfactory than trying to fix a stepped end into a loose-fitting hole with a brittle alloy, and expecting it to stand expansion, contraction, and pressure stresses.

Although the backhead won't be needed yet, it might as well be made while you are doing the firebox casing. It requires a piece of 13- or 12-gauge sheet copper measuring $7\frac{1}{4}$ in. × $4\frac{11}{16}$ in. Bend over $\frac{5}{16}$ in. of each long side, to form the $\frac{5}{16}$ in. flange shown. If you take the ordinary steel insets out of the jaws of the bench vice, and temporarily replace them with two pieces of mild-steel bar, of same section, or as near as possible, but about 8 in. long (they need not be fixed) the bending job will be "a piece of cake." Just put the copper between the bars with the marked line level with the tops of them, and bend over. Either hit with a hide-faced hammer —they were known as "bacon-rind" hammers in the locomotive shop—or use a piece of hardwood as a buffer between an ordinary hammer and the copper sheet. If you're lucky enough to own a bending brake, the job will be the whole cake, including the icing and crumbs. The time that my Diacro gadget saves is beyond calculation. All the holes can be drilled, and the larger ones tapped, as indicated on the drawing; but don't tap the stayholes yet, as they have to serve as guides for drilling the stayholes in the door plate of the firebox, and this cannot be done until the firebox is assembled in the shell. Both lots of holes are then tapped together.



Front of firebox shell (5-in. gauge engine)

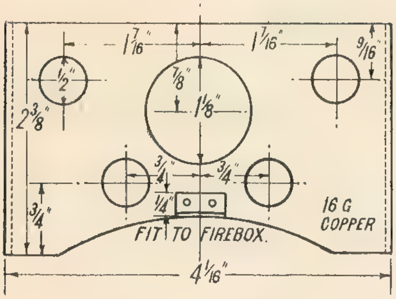


Backhead for 5 in. gauge engine

Firebox and Crown Stays

I needn't dilate on the firebox, as it is made in similar manner to that in the $3\frac{1}{2}$-in. gauge boiler. The dimensions of the former for the tube and door plates, can be obtained from the drawing, where it is shown by a dotted line. The tube holes are set out and drilled on it, as previously mentioned, and the plates flanged up from 13-gauge sheet copper, the tube holes in the copper plate being drilled, using the holes in the former as guide, before removing the copper plate from the former. Open out and ream in the same way as described for the $3\frac{1}{2}$-in. job. Remember that the reamer shouldn't be put too far through the holes in the firebox tubeplate, as the tubes should be a tight fit.

A piece of $1\frac{3}{8}$ in. × $\frac{1}{8}$ in. copper tube, $\frac{9}{16}$ in. long, will be needed for the firehole ring, with a step $\frac{1}{16}$ in. deep and 5/32 in. long, turned at each end. Anneal, squeeze oval, and use it to mark out the position on the door plate, the centre being $\frac{15}{16}$ in. from the top. Then cut the oval hole, and fit the ring exactly as described for the one in the smaller boiler. File off any ragged edges



Crown stay for 5-in. gauge engine

on the flanges of both tube and door plates, and clean up the flanges themselves with a rough file; the more scratches you make in the contact surfaces, the better the brazing material will hold. A piece of 13- or 14-gauge sheet copper $12\frac{1}{2}$ in. long and $3\frac{9}{16}$ in. wide, is bent to an arch shape, to form the firebox sides and crown, and riveted to the flanges of the tube and door plates with a few 3/32-in. copper rivets, to hold the parts in close contact whilst the brazing is under way.

Each crown stay will need a piece of 16-gauge copper, $4\frac{11}{16}$ in. long, and $2\frac{3}{8}$ in. wide. Bend over $\frac{5}{16}$ in. of each short end, to form the flange, and drill the holes for the regulator barrel and long stay rods to pass through. Cut a curved section $\frac{3}{8}$ in deep, out of each bottom edge, to fit very closely to the firebox roof or crown; and in the middle of this, rivet a $\frac{1}{2}$ in. length of $\frac{1}{4}$ in. × $\frac{1}{16}$ in. angle, bent up from sheet copper. These three cross girders are fitted to the firebox crown, spaced as shown, making sure that an equal amount overhangs at each side. Rivet the pieces of angle to the crown sheet, to hold the girders while brazing; the soft copper of which the angles are made, will allow them to bed well down to the firebox roof.

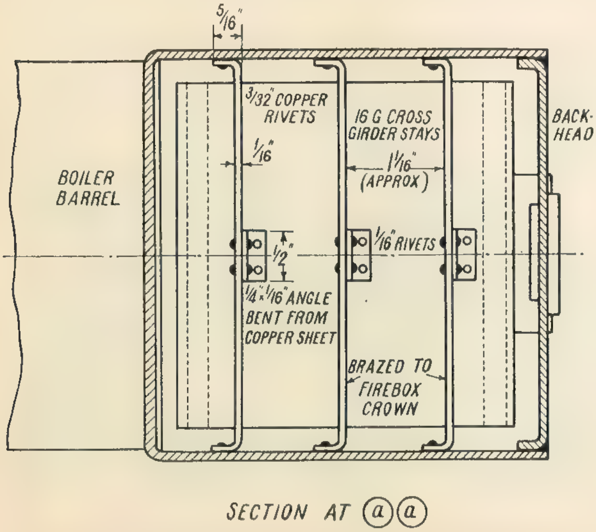
The complete firebox can then be brazed up, as described for the $3\frac{1}{2}$-in. job. When doing the joints between crown stays and firebox, see that you get a good fillet at each side. The best stuff to use for these butt joints, would be either soft brass wire, or Sifbronze, either of which will melt and run at a bright red, but well below the burning temperature of the copper. Use Boron compo as flux for the former. These metals will amalgamate perfectly with the copper, and the joints will be perfectly safe and sound. Let the firebox cool to black, then pickle, wash off, and clean up, ready for fitting the tubes.

Anybody who happens to be keeping level with the notes, and wants a job to keep him busy until the next spasm appears, can go ahead and make the smokebox tubeplate. This needs a circular forming disc $3\frac{3}{4}$ in. diameter; the circle of copper required for the tubeplate, will be $4\frac{3}{8}$ diameter, of 13-gauge metal. Flange it over the former, chuck in three-jaw and turn off the ragged edge, then turn the outside to a tight fit in the end of the boiler barrel. Mark off the stay and pipe holes, and drill and tap as shown. The location of the tube holes can be jigged off the firebox former, as usual, clamping the former to the tubeplate so that the bottom row of tube holes will just clear the flange, as shown. Put the small drill through first, then open out and ream to the sizes given, this time putting the reamer right through, as the tubes should fit easily in the holes when fitting the tubeplate in the barrel. They are expanded to a tight fit afterwards, before being silver-soldered. How to fit the tubes, and erect the firebox in the shell will be the next stage of the proceedings, for both sizes of boiler.

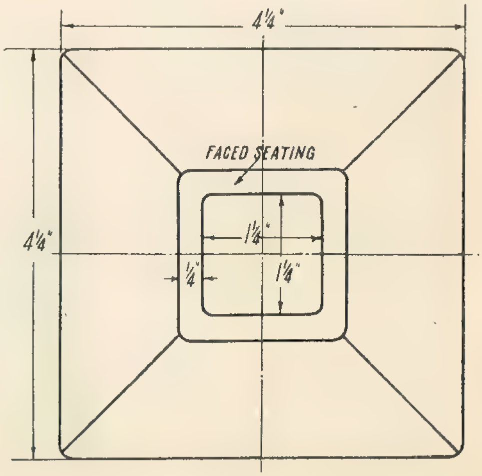
The Answer to "Why"

The question put by Mr. M. H. Cox, in the correspondence columns of December 17th, 1953 issue, is soon answered. I am not describing a "scale model" (hateful term !) of the *Lion*, but two small editions of the *Titfield Thunderbolt, intended to be capable of performing the Titfield-Mallingford Jct. run, at high speed, with a heavy load, over the average back-garden or club track, which isn't exactly laid to billiard-table level or smoothness.* That is the rub ! The wheel castings supplied by our approved advertisers are made strong and serviceable enough to stand the racket. Even if a "scale model" (ugh !) *Lion* were capable of doing the same job—it wouldn't be—the flimsy "scale" wheels which Mr. M. H. Cox

(*Continued on page* 131)



Horizontal section of 5-in. gauge firebox shell, showing crown stays

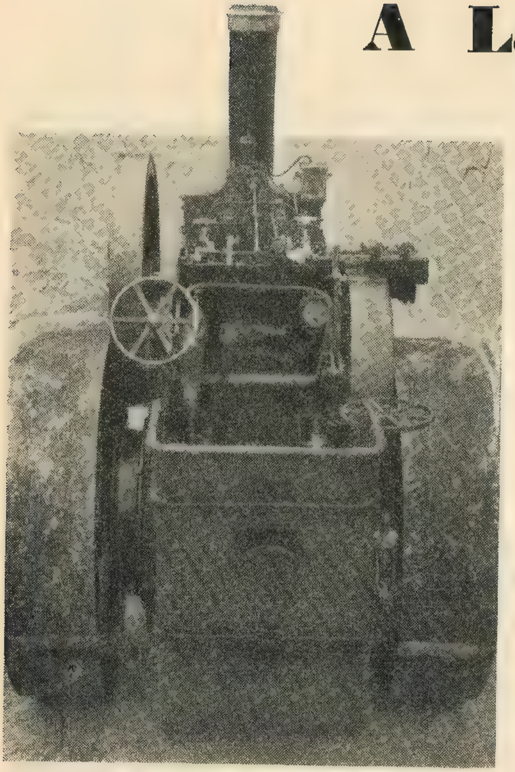


Plan of dome, 5-in. gauge engine

A Large-scale ROAD ROLLER

INTERESTING FEATURES OF ITS CONSTRUCTION

by "Gasbag"



End view, showing controls

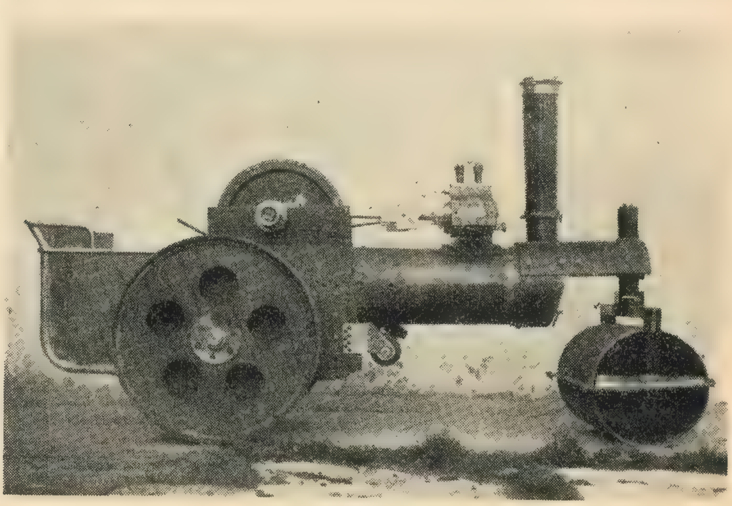
IT is not proposed to give here a description of the construction of the subject in all its details. One steam engine, road or rail, is very much like another; therefore, it will be found that only items of constructional interest, or of extra-large size will be dealt with. From the point of machining, a large road roller or traction engine say, 3 in. to 4 in. scale, involves heavier work than a 10½-in. gauge rail locomotive; having built several of both, I happen to know this.

In the construction of a roller or traction, everything centres around the boiler. So this first claimed attention. The only item of note is that the boiler is of copper, and hornplates of steel. The photograph shows boiler in its early stages, and as will be seen, it is an ordinary locomotive-type without horns. The inner and outer firebox wrapper plates are stayed with copper stays ⅜ in. diameter by 24 t.p.i. These stays are drilled ⅛ in. right through and the hornplates are bolted to them with bolts turned from high-tensile steel and having round heads on the outside to represent stays. The hornplates are carried below the actual foundation ring for ⅞ in. tied by 1-in. by ¼-in. flat steel, which also act as grate bearers. Above the boiler the hornplates are tied by archplate, etc.; thus, a strong and solid box is formed and, moreover, the side bolts do not carry the whole shearing load of the weight of the rear of the engine.

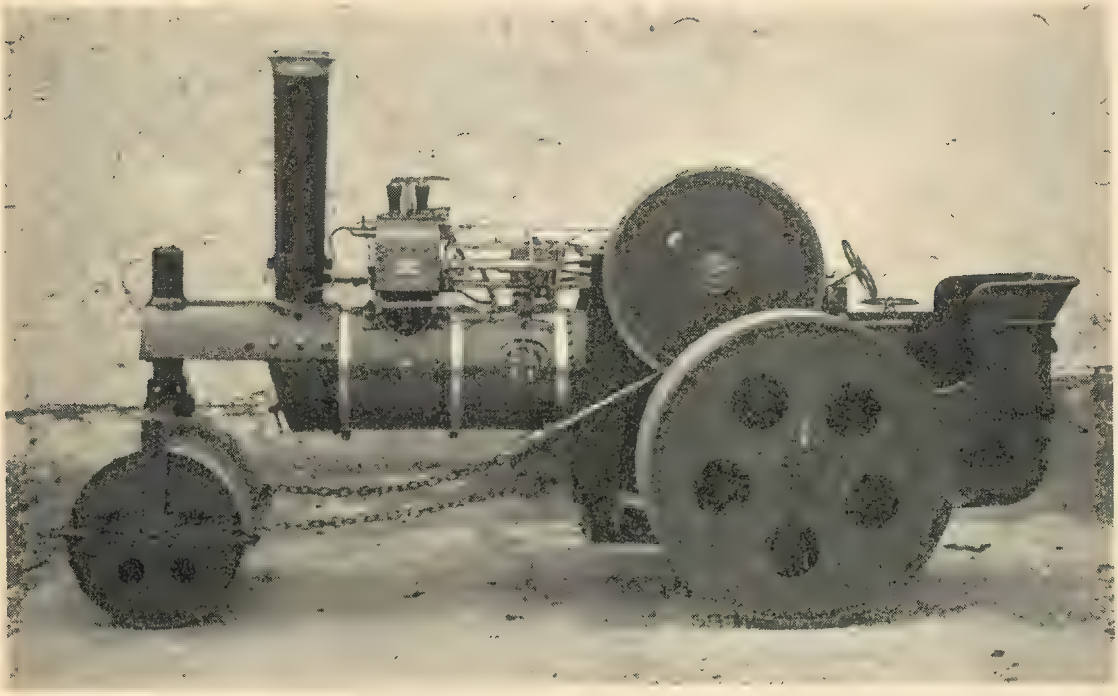
The front saddle bracket, for steering roll fork, and also the fork are fabricated. Castings for these items were ruled out in view of the amount of pattern making required for what would be a one-off job. A piece of steel tube of $\frac{5}{16}$-in. wall thickness and a fit upon smokebox, was cut to outline of saddle with the acetylene cutter, and a 3 in. hole was cut for the insertion of a piece of 3-in. tube for chimney base. At the front, a 2¼-in. hole was cut for the pillar support of the front fork. This latter item is turned from 2¼-in. square mild-steel and bored 1⅜ in. for two phosphor-bronze bushes top and bottom to take the fork pillar. This assembly was then welded together with runs to allow being filed subsequently to the radii of the fillets required. A piece of ¼-in. plate is welded into the front and the 2¼-in. section welded thereto; this all makes a neat and much stronger job than a casting.

In the matter of the fork, this was also welded from 1½-in. square section mild-steel which was machined to the required tapers on the shaper, the ends of the top member being turned and screwcut ⅜ in. gas and fitted to the side pieces, which were bevelled off for welding. When welded up and filed, this item again was probably very much stronger than a casting.

The next problem to provide food for thought was the compound



Three months work—all heavy work completed



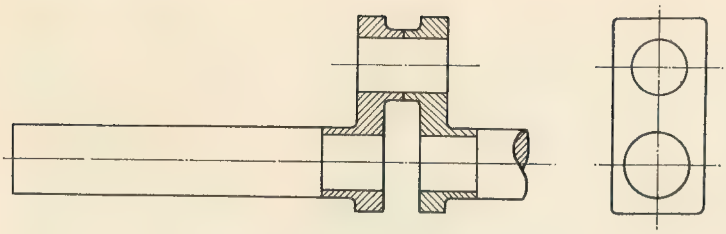
Side view of the large-scale completed roller

cylinder block. The actual machining of bores, etc., was plain straightforward turning, but sweeping the saddle to fit a boiler of 8 in. diameter proved not so easy. My largest lathe has a swing in gap of 20 in. by 6 in. in front of faceplate, which itself is 18 in. diameter. A cylinder casting weighing 40 lb. set upon an angle-plate, and the weights required to counterbalance this load, proved rather more than the lathe could take. It was, therefore, decided to make the cylinder in two parts; that is, the block itself with bores and port faces, etc., were cast as one item and the saddle to fit boiler as another, the line of severance being at the mean of the radii sweeping from saddle to join the actual radii of ends as struck from the axes of cylinder bores. Not only does this method render the machining of saddle radius a simple matter, but also the cutting of the various steam passages to connect cylinders and the exhaust can be dealt with by end-milling and far more suitable steam and exhaust ways formed.

And now a word about the gearing. This, I think, is something which deters a number of people from building a roller or traction. However, in my humble opinion, if you do not cut your own gears you cannot say you built the job. The means of gear cutting at my disposal consist of a plain horizontal miller and a home-made dividing-head, and a great many gears have been cut on this. The head, however, will not admit of gears greater than 8¼ in. diameter being cut thereon. Now, on this roller, it was proposed to use gears of 10 d.p., first, because it was not far from scale, and secondly because I cut quite a few 10-d.p. gears for another purpose; thirdly and lastly, it is nice and easy to work out gear centres. Now on the spur-ring the gear diameters are: fast speed, 9 in., and slow speed, 10 in. p.c.d., the final drive pinion being 15 in. p.c.d. It will be seen, therefore, that the cutting of these was outside the scope of the dividing-head, but I have another head, the use of which I have not before seen described. This head does not make use of the longititudinal feed of the miller, but the vertical feed, the head being bolted upon the table and the work feed from below, the depth of tooth being regulated by the table feed. With this method, a gear of any size may be cut, governed only by how far back the table may be withdrawn from the cutter arbor.

In this case, as no division plate is used, the gear is indexed from a 20-d.p. change-wheel; but only gears in multiples of 5 may be cut 60, 70, 80 and so on. Many traction engine firms used wheels of an odd number of teeth say 59, 67, etc., in order to incorporate a hunting tooth in the wheel to equalise wear; but in my job, this was of small moment. The sketches I think will make these remarks on the gearing clear.

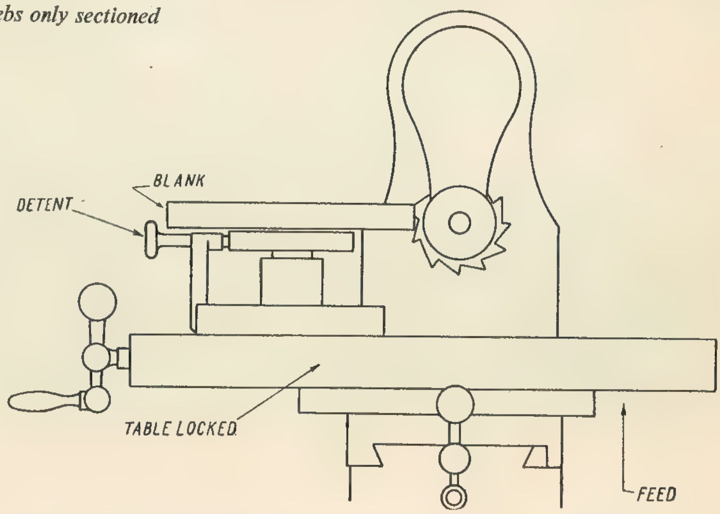
And now arose one of the heaviest and most unpleasant jobs on the engine, the making of the rolls. I have never cared for the usual spoked traction engine type wheel or roll, and, some years ago, having charge of a works producing and repairing a good deal of road-making plant, I replaced a number of the spoked type with disc or plate wheels or rolls. This type of plate roll was fitted to "The Advance" roller by Wallis and Steevens, and also to other types of their rollers as and when repaired by them. A very similar type of wheel was used a good many years before this, however, in the seventies and eighties of the last century, for tractions both by Barrows and Stewart of Banbury and Eddington and Steevenson of Chelmsford. The rolls on the engine in question are 18 in. diameter by 4 in. face on hind rolls and 11 in. diameter by 6¾ in. each roll on steering rolls.



Half crankshaft—webs only sectioned

For the rolling of the sections to circular form, the method of creep rolling was adopted. In case any readers are not familar with this, I may say that in a normal plate or boiler shop, this is done under a hydraulic press with the aid of a cast-iron channel, or sometimes a vee-shape block. Bolted to the tup of the press is a small bolster. By pressing in a series of intervals as a plate is passed underneath, the operator can bend the plate to the radius required. It is a somewhat slow process and requires a fair amount of skill if accurate work is required; large saddles for boiler and tank work are sometimes produced in this way instead of on bending rolls.

I have no hydraulic press, but this is no drawback as its place can be taken for light work by two 1-in. Whit. bolts. A length of 95-lb. bull-head railway rail, 2 ft. 6 in. long had $1\frac{1}{16}$-in. holes drilled each end to take the foregoing bolts, and a piece of $2\frac{1}{2}$-in. square mild-steel also 2 ft. 6 in. long, drilled for bolts, was turned in the lathe on one face to a radius of 2 in. This done, I was ready to roll the plates, which were prepared slightly over length. By the tightening of the nuts at intervals as the plate was fed through, and by working to a sheet-iron template, the plate was finally rolled into a circle, those for the steering rolls requiring a good deal more work than the hind rolls.

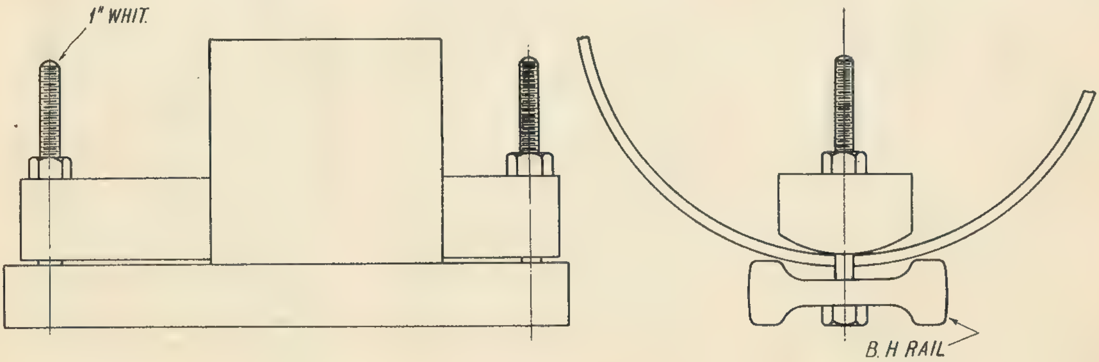


Set-up for cutting spur-ring

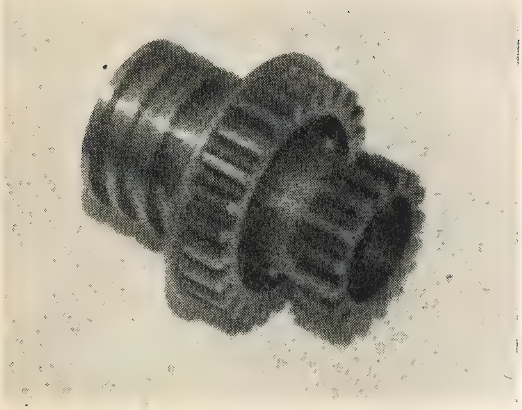
The angle-rings were pulled round a former upon the slab, to the radius required. These and the roll rims were then bevelled off and welded. Both roll and angle were skimmed up in the lathe, and riveted up on rim and hubs. The whole roll was then set up on the faceplate true to rim face, and bore-skimmed out to $1\frac{3}{4}$ in. and bronze-bushed to $1\frac{1}{2}$ in. for hind axle.

The tender was rather a problem, on the grounds that some makers of traction engines used to form the sideplates to about a 2-in. radius to obviate an angle. Not wishing to get a former for this job and making the side-plates in 13-s.w.g. steel, a 1-in. o.d. by 13-s.w.g. steel tube was slit into four quarters on the miller; these, together with a suitably curved piece for bottom, were then welded all round back and bottom of side plates. A $\frac{1}{2}$-in. strip was welded to this to make a $\frac{3}{4}$-in. flange in all. It may also be said that the rear channel section for drawbar was fabricated by welding two angles down the centre to form a channel. In any work of this class, the main thing to guard against is distortion.

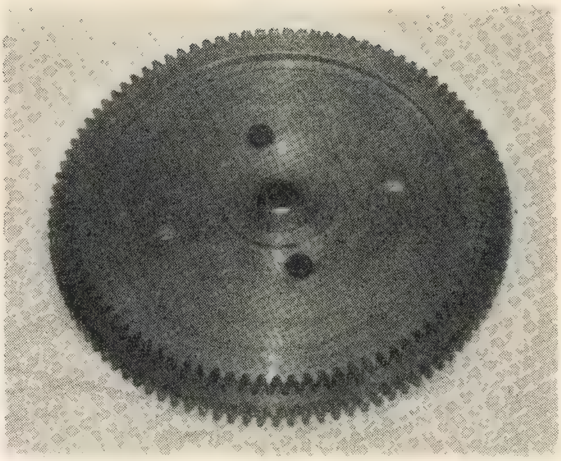
The final item which may be said



Details of the bender



Crankshaft or first drive pinion



The spur-ring

to be out of the usual run is the crankshaft. This is 14 in. long by 1 in. and $1\frac{1}{8}$ in. diameter, the crank webs being $\frac{7}{16}$ in. thick; crank throw is $1\frac{5}{8}$ in. and crankpins 1 in. diameter. Carving out of the solid was ruled out as a waste of time, as a lump of 3 in. square mild-steel would have been needed. It was therefore decided to build this up. As the crank webs were only $\frac{7}{16}$ in. thick and would not have afforded a secure seat, other means were used. I may say that the brazing, or welding of the shaft into the webs I would not for a moment consider on any crankshaft, as to me, it is "botching" of the highest class!

The actual method adopted was copied from a large diesel engine crankshaft, and I think the drawing is self-explanatory. The webs were cut from the fore axle of an old portable and roughly machined on shaper. Each web was then marked off and bored $\frac{7}{8}$ in. At $1\frac{5}{8}$ in. centres, another $\frac{7}{8}$-in. hole was jig-bored from this. Each web was then set upon a mandrel and rough-turned to leave a full $\frac{7}{16}$ in. of web, and on one end a $1\frac{1}{4}$ in. spigot was turned and the other spigot finish-turned to 1 in. The remainder of the shaft was turned from high-tensile steel.

The forcing together was done under a small frame with a hydraulic jack. The interference allowed was two thou. It may be said that a crankshaft so formed is far more rigid than one turned from solid; in fact, all the finish turning on the crank, when pressed together, was done between centres without any packing between crank webs with no sign of chatter. That I think concludes most of the items out of the usual run. I am aware that an engine of this size is beyond the reach of most, if only on account of cost; but perhaps some of these methods may lend themselves to smaller models.

Working Hours

For those interested in times, may I give the following?

Compound cylinder block, complete with valves pistons, stop valve, and safety valve, but no drain cocks—65 hours.

Spur-ring pinions, including burning from $\frac{3}{4}$-in. steel plate to fitting on to the engine—18 hours.

Sliding pinions for crankshaft, including four male and female $\frac{1}{4}$ in. by $\frac{1}{4}$ in. splines—30 hours.

The four rolls, including all burning from plate, machining and bushing ready to fit to engine—85 hours.

The crankshaft complete with four splineways but less eccentrics—24 hours.

Tender complete with all details and brake gear—60 hours.

L.B.S.C.'s TITFIELD THUNDERBOLT

(*Continued from page* 127)

craves, would simply fly to pieces as soon as the engine hit the high spots, and the bad joints and gaps in the track, at the same time. Such things *have actually happened*; ask our friends at Glasgow and two or three other places. If Mr. Cox is so keen on "scale" wheels, the best advice I could offer him, would be to follow the example of that master-craftsman, the late Dr. Bradbury Winter of blessed memory, and cut his wheels from discs of solid steel. Only then, will he get the required lightness and strength combined.

Red Tail Lamp

Replying to several correspondents, the drawing of the $3\frac{1}{2}$-in. mechanical lubricator will appear as soon as I have had time to make a fresh one. My drawing-board slopes like a desk, and I stand when drawing; and while finishing the original drawing of the lubricator, bending over the board, my nose suddenly started to bleed (Nature's safety-valve for relieving blood-pressure) and spoiled my lovely hieroglyphics. I thought at first of writing a thriller around it—you know the sort of thing, "Murder in the Lubricator," by Agnes Christopher, and sending it in for the Christmas number; but our worthy K.B.P. might have tried to see how the said B.P. matched the predominant colour of the drawing, and decided that it wasn't suitable! Anyway, builders of the $3\frac{1}{2}$-in. "*Tit*" have plenty to go on with; and if all goes well, I shan't keep them waiting long for the missing bit.

IN THE WORKSHOP
BY DUPLEX

FINISH-GRINDING TUNGSTEN-CARBIDE TOOLS

BEFORE continuing with the construction of the grinder, it may be as well to point out that, although the machine is primarily intended for sharpening carbide tools, it is just as useful for finishing the cutting edges of high-speed steel and carbon-steel lathe and shaping machine tools. With the fine-grit wheel fitted, the finish of the ground surfaces is almost indistinguishable from that obtained by oilstoning, and there is the added advantage that there is no danger of rounding the cutting edges. If only a few tip angles are adopted as workshop standards, resharpening a tool can be very quickly carried out, as the grinding angle is readily set from the engraved scale by turning the adjusting-screw. Now that the grinding head itself has been completed, it remains to describe a suitable form of base mounting, together with an adjustable tool rest and a graduated, angular setting device.

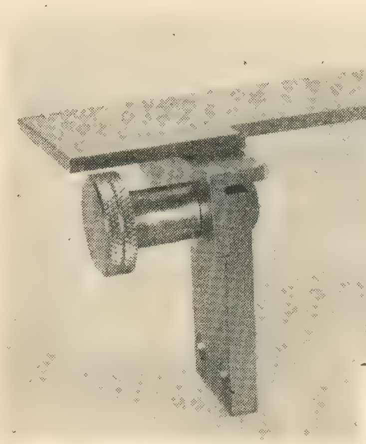


Fig. 15. The table assembly viewed from behind

Continued from page 79, January, 21, 1954.

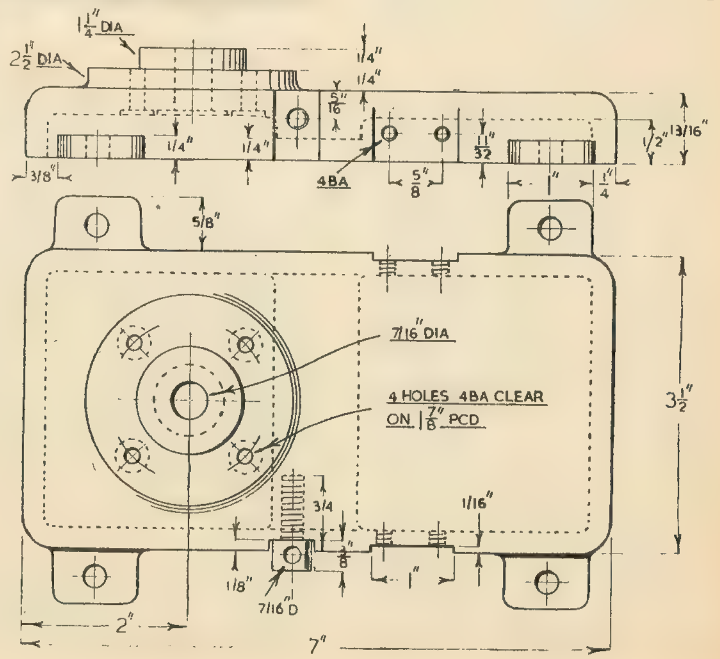
The Base Fig. 13

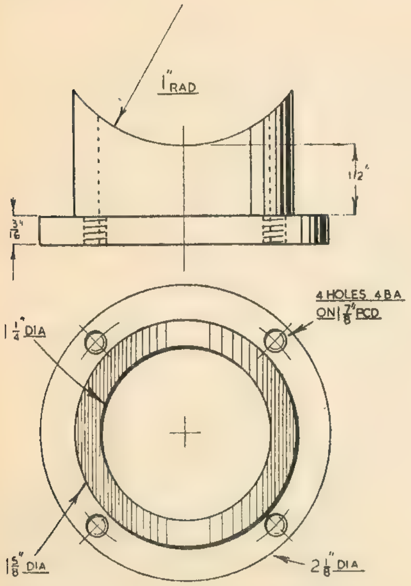
This is an aluminium alloy casting, supplied by Mr. Haselgrove. The original iron castings were rescued from a scrap-heap and were designed to form the base of a small drilling machine. Several of these castings have been utilised in the workshop for mounting various small machines, and even photographic apparatus for use on the bench.

At the start, the underside of the base is either machined or filed flat, so that it will rest on the surface plate without rocking. The central boss can be turned to diameter and faced by mounting the casting on the lathe faceplate, but if the part is too large to swing in the gap, as happened in our workshop, then the casting will have to be bolted to an angle-plate secured to the lathe cross-slide, and the machining is carried out with a boring head fitted with a star-wheel feed.

The latter is the method we adopted, and this may form the subject of a later article, as it enables some quite large and awkwardly-shaped castings to be bored,

Below: Fig. 13. The base casting





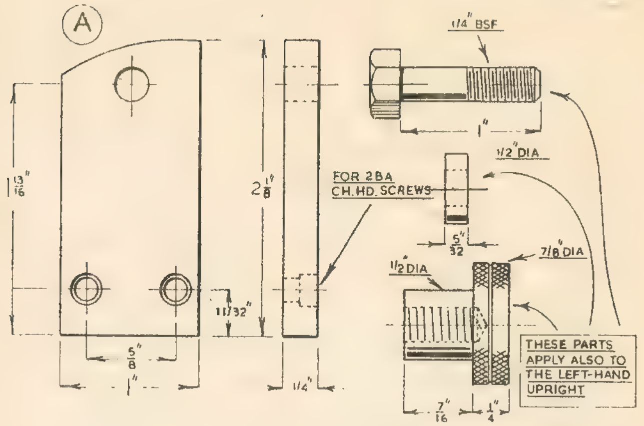
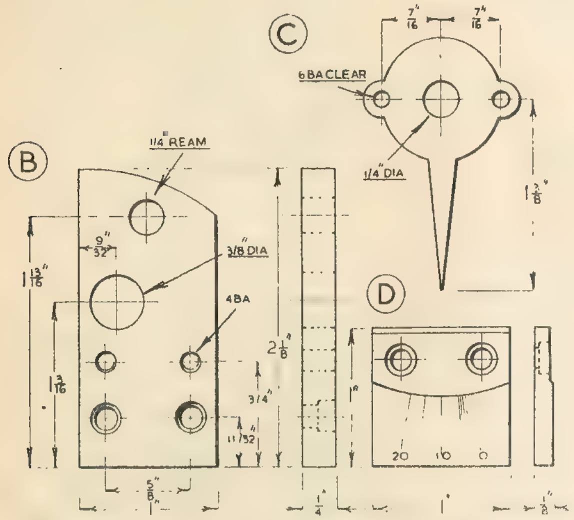


Fig. 16. *The right table upright and pivot bolt*

Left: *Fig.* 14. *The saddle mounting*



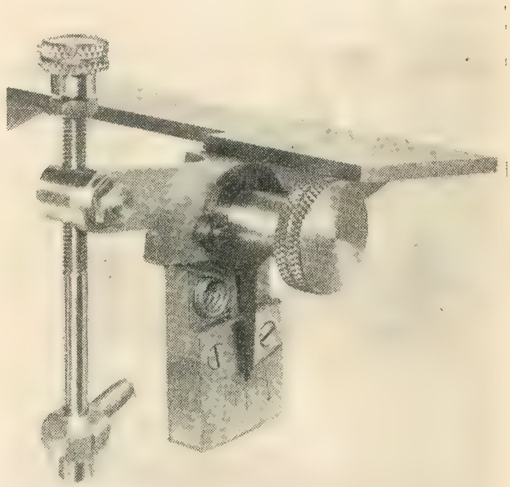


Fig. 17. *B—the left table upright; C—the pointer; D—the index plate*

Fig. 18. *Showing the table adjusting mechanism and the angular scale*

faced, and screwcut in a lathe of moderate size. The four 4-B.A. holes for attaching the next part, the saddle, are best drilled later with the parts in place.

Ths Saddle Fig 14

The material actually used for making the saddle came out of the scrap-box or, as it is perhaps better termed, the spare parts box. This flanged sleeve once formed part of the distributor gear of a magneto, but a waste-pipe socket, obtainable from the plumber, should serve equally well.

The hollow to receive the grinding head is easily machined by a fly-cutting operation, and the details of setting the cutter to the exact radius required were given in a recent article; alternatively, the fitting can be done with hacksaw and file after the part has been accurately marked-out, but this marking-out might well take longer than the simple machining operation.

Next, the grinding head is bolted down to the saddle when in position on the baseplate and, with the saddle clamped in place and the head afterwards removed, the holes for the fixing-screws are drilled right through both parts.

The Table Assembly Fig. 15

To show the constructional details, the grinding table assembly was photographed from the back, and the right and left-hand parts are, therefore, seen reversed in relation to the following description.

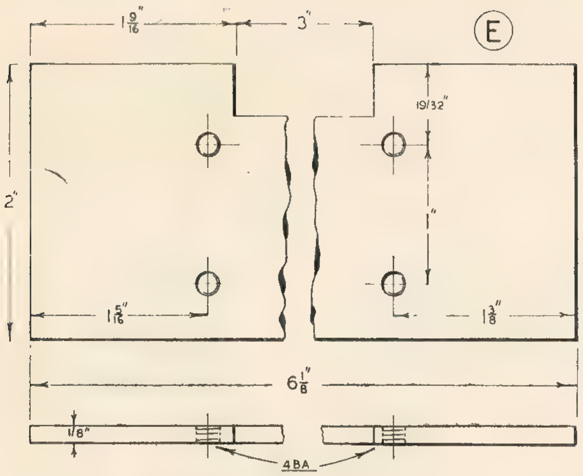


Fig. 20. *The grinding table*

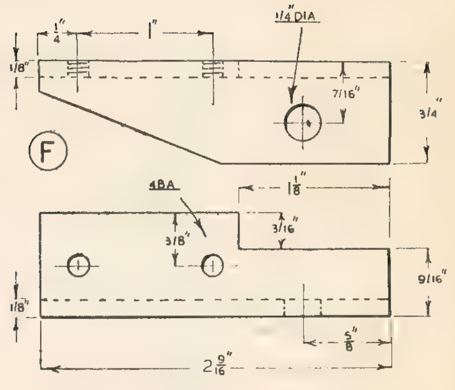


Fig. 21. *The right-hand table bracket*

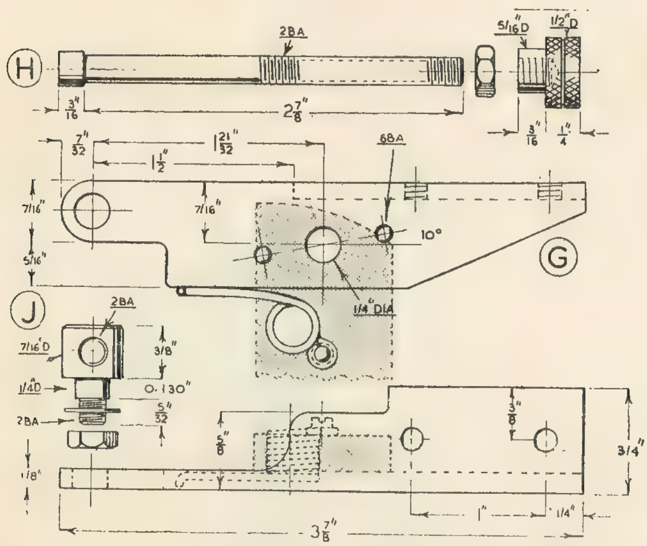


Fig. 22. *G—the left-hand table bracket*; *H—the adjusting-screw*; *J—the bracket trunnion*

Both the right and left-hand uprights supporting the table, *A* and *B* respectively, fit closely into the base and are fixed in place with 2 B.A. screws. To ensure uniformity the two plates should be clamped together when drilling the screw and bolt holes.

The Table Brackets F and G

For mounting the table so that it can pivot on the two uprights, the two supporting brackets are cut to shape from $\frac{3}{4}$-in. × $\frac{1}{8}$-in. steel angle; these are then drilled for the $\frac{1}{4}$-in. diameter pivot bolts, so that the table can be securely clamped by means of the knurled finger-nuts and distance collars illustrated in Fig. 16.

After the table has been cut to shape, it is clamped in position on its brackets to enable the holes for the fixing-screws to be spotted from below and then drilled and tapped. After assembly, the table should rotate freely on its pivot bolts, but should become firmly fixed on tightening the knurled nuts.

The Table Adjustment

As shown in Figs. 18 and 22, the table is depressed by means of a spring carried in the left-hand upright; the free end of the spring bears against the lower edge of the table bracket and the other end is fixed with a cheese-head screw to the inner side of the upright.

The table is raised or lowered by turning the knurled nut fitted to the upper end of the threaded rod *H*.

As shown in Figs. 13 and 18, the lower end of this shouldered rod is carried in a trunnion, screwed into the baseplate but free to rotate. Towards its upper end, the rod engages the threads trunnion *J* which rotates in the table bracket *G*.

Provided the work has been carefully carried out, this arrangement gives a smooth and accurate adjustment for setting the angularity of the table.

Indexing the Table Setting

The angular setting of the table is made with reference to the pointer *C* and the engraved scale *D*, illustrated in Figs. 17 and 18. It should be noted that the holes in the bracket *G* for attaching the pointer are drilled at an angle of 10 deg. from the horizontal so that, when the table is in the horizontal position, the pointer will register with the zero line on the scale. However, should any adjustment of the pointer be needed after assembly, the screw holes can be opened out accordingly, but with ordinary careful working this was not found to be necessary. The index plate with its engraved scale is attached to the upright *B* by means of two flush-fitting, 4-B.A. cheese-head screws.

Graduating the Index Plate D

A strip of $\frac{1}{8}$-in. × 1-in. mild-steel is marked-out with a centre to correspond to the centre of the table pivot bolt, and from this centre two arcs are scribed with the dividers to indicate the upper and lower limits of the scale lines. If a

dividing attachment is available, the graduation lines can be readily engraved in the lathe by clamping the work to the faceplate with the marked-out centre set to run truly. The lines are then cut with a V-tool, having an included angle of 30 deg. to 45 deg. However, the Drummond lathe lacks a dividing head and, instead, a Richmond rotating table was used on the faceplate. A draw-bolt was fitted to the ½ in. diameter central hole in the table and, after the ½ in. diameter projecting end of the bolt had been set to run truly, the work was bolted in place as illustrated in Fig. 19. To give greater security, a T-bolt was used to hold the outer end of the work.

Next, a flat groove, a few thou. in. in depth, was machined in the work surface to form the base line of the scale and to enable the tool to start cutting when fed in an outward direction.

The Richmond rotating table is very accurately made, and it was an easy matter to engrave the scale lines exactly 1 deg. apart. The length of the lines is a matter of personal choice, but it may help if a standard scale with 1/10 divisions is used as a guide.

After the work has been removed from the lathe and the coiled chips broken off with a strip of brass, the remaining burrs are removed either with a smooth file or by rubbing the part on an abrasive stone. The index plate is next drilled for the fixing screws and then cut to the finished size.

When the machine has been assembled, the table is set square with the face of the grinding wheel and the pointer should then register with the zero line on the scale.

As the upper surface of a lathe tool is usually ground first, and the wheel must rotate towards the cutting edge, the direction of rotation of the wheel will have to be reversed for grinding the side rake on a right-hand knife tool.

There is, of course, no difficulty in reversing the wheel where the motor is fitted with a reversing switch, but we find that crossing the small, round belt gives satisfactory working, provided that the fastener is carefully fitted so as not to cause scuffing of the belt at the point of crossing.

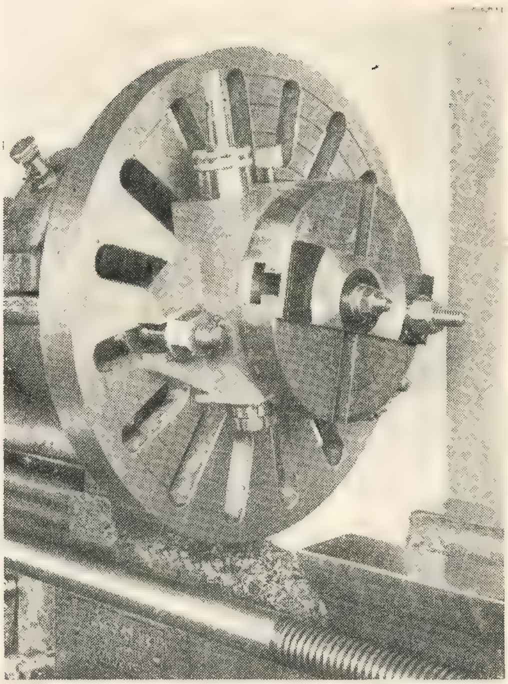


Fig. 19. Graduating the index plate in the lathe

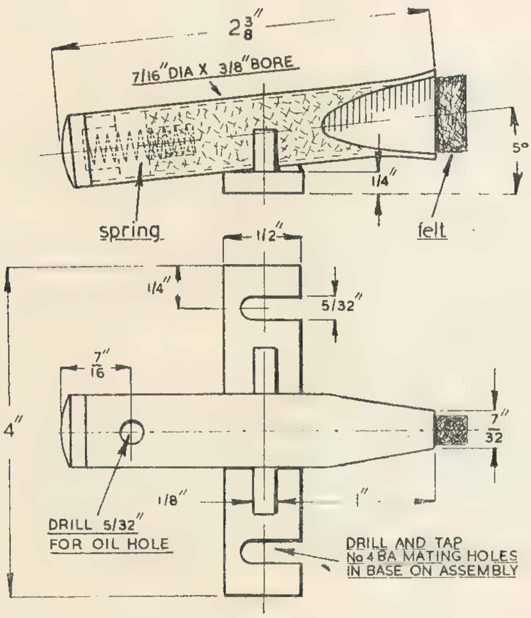


Fig. 23. The wheel lubricator

As shown in Fig. 1 of the previous article, the machine is attached to a wooden base, and this, in turn, is secured to the main baseboard by means of a single bolt, working in an elongated slot of sufficient length to allow for slackening and tightening the belt.

Manufacturers advise feeding oil to the surface of a diamond wheel when sharpening carbide tools, and this practice also seems to be beneficial where a silicon carbide wheel is used. The wheel absorbs some of the oil and this appears to keep the surface of the wheel clean; in addition, a very high finish is left on the tool and overheating of the edge is avoided. For maintaining a supply of thin oil to the wheel, the lubricator illustrated in Fig. 23 was secured to the baseplate of the machine. The holes for the attachment-screws are slotted so that the lubricator can be withdrawn when the machine is not in use. The felt wick is pressed against the wheel by means of a light spring and, after the oil has been replenished, the oil hole is closed by means of a circular clip. However, very little oil is required to lubricate the wheel face, and any excess will be thrown off by centrifugal force as soon as the wheel is started.

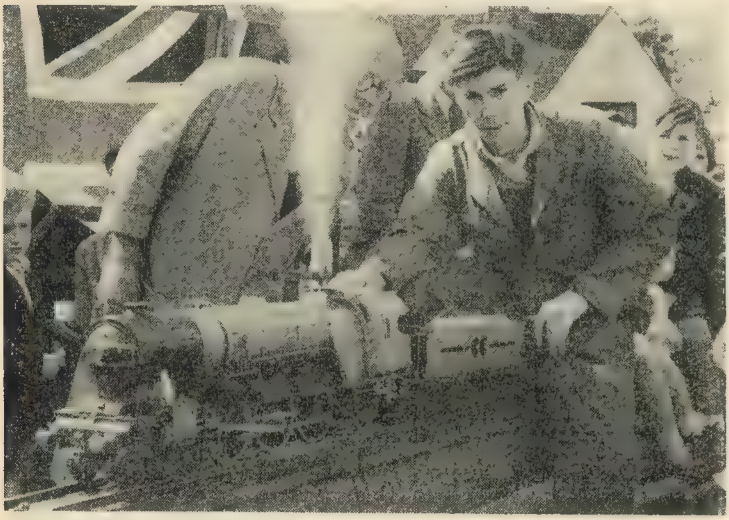
"L" PLATES AT THE BENCH

(*Continued from page* 123)

By this time the place was beginning to look a little more like a workshop and shelves and hooks were going up at a rapid rate. I am now faced with the following problems: (1) Shall I go to the expense of fitting more and larger windows, or shall I dispense with daylight and install a bigger and better lighting system than that originally visualised? (2) What to do about the floor. I have never yet done any concrete work and do not view the prospect with glee. Will it be simpler to level-up only as and where needed? (3) Our old, old friend, *rust*. There is nowhere like the seaside for putting a thick brown coat on shining tools in a matter of days. (4) Some sort of heating system must be decided on, having due regard to Problem 3 and to the fact that it is nippy round our way in winter.

Undoubtedly the power situation must be tackled first because, as a temporary measure, I have done a typical "Raf" lash-up to get some light in which is going to make Messrs. Amp and Ohm at the electricity office very unhappy if they see it! So while awaiting this step—not only the electrician, but the wherewithal as well—I am brooding on machine tools. A lot of my brooding may prove to be a pipe-dream, but can *you* think of a better way to spend an evening?

(*To be continued*)



Mr. S. T. Longley of Maidstone has sent us this photograph of his $3\frac{1}{2}$-in. gauge Pacific locomotive at work on the Maidstone M.E.S. track in Mote Park. The engine was originally built to the drawings of E. W. Twining, which were reproduced in the " M.E" in July 1915, *but has since been considerably altered*

WITH THE CLUBS

North London S.M.E.

The permanent rail track, which the society has for some time been building at Arkley, near Barnet, is expected to be completed and in use this summer. It is continuous for a distance of 492 ft. and has very generous curves of 45 ft. radius, and will accommodate locomotives of $2\frac{1}{2}$ in., $3\frac{1}{2}$ in., and 5-in. gauges. We shall hope that our many friends from other societies, will, in due course, give it a trial.

Future general meetings as follows:—

Feb. 5th. Film show.

Mar. 5th. Jumble sale (auction).

Held by courtesy of Eastern Gas Board at their offices in Station Road, New Barnet, at 8 p.m.

Hon. Secretary: W. W. RANSOM, 6, Arundel Court, 127, Woodhouse Road, N.12.

York City & District S.M.E.

Meetings will in future be held on alternate Saturday evenings, at 7, until the end of April; then during May, June, July, and August there will be only one meeting each month. Afterwards we revert back to fortnightly meetings. This applies only to our indoor meetings at The Rachabite Building, in Clifford Street.

Dates to note are:—

Feb. 13th. Business and general topics.

Feb. 27th. " Printing " explained by the secretary.

It is hoped we will be able to get the loco track going at Easter, and a full programme for the summer is being arranged.

Hon. Secretary: W. SHEARMAN, 28, Terry Street, York.

The Wakefield S.M.E.E.

The following meetings will take place during February, at 7.30 p.m., in the R.A.F.A. Club Headquarters, Old Black Swan, off Silver Street, Wakefield: 10th, Instructional evening. A talk by Mr. R. Elvey on a workshop and various workshop matters.

Any club business needing discussion will be discussed on this night. 24th, a talk by Mr. T. E. White, B.Sc., M.I.C.E., on " Dam Construction." This will be a further talk and film by Mr. White on the construction of the new dam which is to feed Wakefield with water, and should be a very interesting evening.

Hon. Secretary: J. S. JACKSON, Marlborough House, Marlborough Street, Headlands, Ossett, Yorks.

Harlington Locomotive Society

The annual general meeting was held on January 7th and the officers elected for 1954.

The chairman reported a very satisfactory state of affairs existed financially and the looked forward to a very progressive period during the ensuing year.

This year especially opens a new era in the society's existence, the solicitors for the society are completing the legal details for the purchase of the existing site and also extension of same, due in no small measure to the generosity of the president, C. E. Shackle, A.M.I.C.E., in making this possible, the land being part and parcel of his estate.

Work has already commenced on the extension of the multi-gauge railway which, when completed, will with existing system give a continuous run of about a quarter-mile. The work in hand entails considerable manual labour, also practical work in survey and civil engineering under the able guidance of the president.

Hon. Secretary: P. WAKE, 25, Sipson Lane, Harlington, Middx.

The Hatfield and District S.M.E.

The society has been fortunate in acquiring premises where a workshop has been established and the construction of an "O" gauge layout has reached an advanced stage.

Our small but enthusiastic " Live Steam " section has been on passenger-carrying duties at several local fetes and parties through the year, using $3\frac{1}{2}$ in. gauge equipment generously loaned by a member.

Meetings are held every Thursday evening and the workshop is available for use at any time.

New members can be sure of a hearty welcome, and any lone hand is invited to contact the Hon. Secretary: F. W. DUNHAM, 57, Lockley Crescent, Hatfield, Herts.

Private: 3d. per word. Trade: 6d. per word. Minimum 12 words. Use of box 1s. 0d. extra.

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"Impetus" machines, wood planers, motorised drills, belt sanders, electric motors, paint sprays, air compressors, circular saws, etc. Catalogue.—JOHN STEEL, Castlefields, Bingley.

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Exchange. Austin 7 shooting brake, four seats, new tyres, taxed and insured six months. Nice condition, for $3\frac{1}{2}''$ to $5\frac{1}{2}''$ lathe or 7" power shaper.—MR. J. WINDER, 29, Cecilia Road, Feniscliffe, Blackburn, Lancs.

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$1\frac{5}{8}$ M.E. Lathes, £8 10s. 0d. Chucks, tools, etc. supplied. 12" Bench Fretsaws, £5 5s. 0d. Satisfaction guaranteed. S.A.E. for leaflets.

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Portable Tools, Wolf drills, screwdrivers, hammers. Unused at reduced prices. Send for list.—JOHN CASHMORE LTD., Great Bridge, Tipton, Staffs.

Whiston for Nuts, Bolts, etc., rivets 1/32" dia. up, plastic belt, silver solder, silver steel, screwed rod, ballraces, etc. Send for 1,000 item list.—K. R. WHISTON, (Dept. M.E.S.), New Mills, Stockport.

Approx. 13,000 Hardened and Ground Drill Bushes, assorted sizes up to $\frac{1}{16}''$ i.d., £50.—THOMAS, 23, Sullivan Way, Elstree, Herts.

"Acorntools" and "Acorntools" De Luxe 5" s.s. and s.c. lathes, also "Acorntools" 7" stroke high-speed shapers and $\frac{1}{2}''$ capacity capstan lathes can be supplied *ex*-stock. Hire purchase terms available. Send for literature and full details to the manufacturers of these machines.—THE ACORN MACHINE TOOL CO. (1936) LTD., 610-614, Chiswick High Road, Chiswick, W.4. Tel.: Chiswick 3416-7-8-9.

The $2\frac{1}{2}''$ × 10" E.W. Lathe. Unrivalled in its class. Plain lathe £13 4s. Fully convertible to back gear and screwcutting. Can be obtained on the easiest of terms from 5s. weekly. Send s.a.e. for details. Adept lathes, shapers. Britinol blow lamps. No interest, no fuss, credit terms. Details s.a.e. —WANSTEAD SUPPLY CO., 48, High Street, London, E.11.

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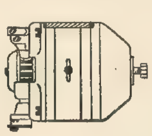

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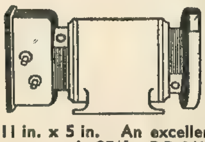

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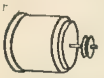

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Drummond $3\frac{1}{2}''$ Lathe, maker's stand, treadle, $\frac{1}{4}$ h.p. 230 a.c. motor, overhead cantilever milling drive, seen working, £25.—Box No. 7167, MODEL ENGINEER Offices.

Zyto $3\frac{3}{8}''$ B.G.S.C. Lathe, 4" 3-jaw and 4" 4-jaw chucks and $\frac{1}{2}''$ drill chuck. New December, 1952. Seen week-ends or evenings. What offers?—A. J. BUMSTEAD, 44, Leigh Road, Hildenborough, Tonbridge, Kent.

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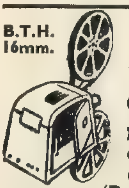

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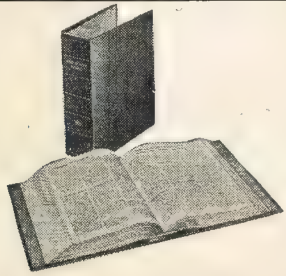

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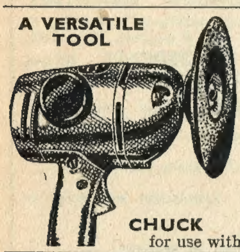

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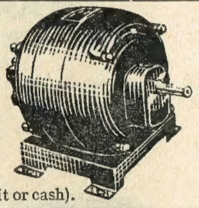

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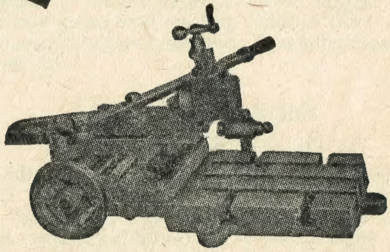

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